ASSESSING FULL SPECTRUM BCT ENGINEER CAPABILITY

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by

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

ASSESSING FULL SPECTRUM BCT ENGINEER CAPABILITY, by MAJ Clay Morgan P.E., 85 pages.

The full spectrum doctrine of the U.S. Army places additional emphasis on engineer units to support offensive, defensive, stability, and civil support operations, yet organic engineer capability was reduced in the BCTs. This thesis attempts to determine if BCTs have sufficient organic engineer capability to conduct full spectrum operations. The author researched the doctrine, missions, and authorization documents of the BCTs to observe that they have similar mission statements and CMETLs, but remarkably different organic engineer capability. Commander accounts presented high probability engineer tasks and revealed gaps when compared to authorized engineer personnel and equipment. The author assessed the SBCT engineer company as the most capable, but identified critical gaps in the HBCT and IBCT engineer capability. The analysis indicated the addition of special engineer equipment, primarily assault bridging and breaching equipment, was essential to the IBCT and HBCT in order to accomplish the assured mobility tasks. The author also recommends a third combat engineer platoon for the IBCT to match the structures of the HBCT and SBCT engineer companies.

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ACRONYMS

ABV	Assault Breaching Vehicle
ACE	Armored Combat Earthmover
AVLB	Armored Vehicle Launched Bridge
BCT	Brigade Combat Team
BSB	Brigade Support Battalion
BSTB	Brigade Special Troops Battalion
CAB	Combined Arms Battalion
CMETL	Core Mission Essential Task List
CTA	Common Table of Allowances
DMETL	Directed Mission Essential Task List
DTSS-Light	Digital Topographic Support System-Light
FMSWeb	Force Management System Web Site
FSC	Forward Support Company
HBCT	Heavy Brigade Combat Team
HEMTT	Heavy Expanded Mobility Tactical Truck
HMEE	High Mobility Emplacement Excavator
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HQDA	Headquarters, Department of the Army
HSTAMID	Handheld Standoff Mine Detection System
IBCT	Infantry Brigade Combat Team
IVMMD	Interim Vehicle Mounted Mine Detector
JAB	Joint Assault Bridge
JMETL	Joint Mission Essential Task List

JRTC	Joint Readiness and Training Center
LOC	Lines of Communication
LOGCAP	Logistics Civil Augmentation Program
LSA	Life Support Area
MEB	Maneuver Enhancement Brigade
MGB	Medium Girder Bridge
MICLIC	Mine Clearing Line Charge
MOPMS	Modular Packed Mine System
MRBC	Multi-role Bridge Company
MSR	Main Supply Route
MTOE	Modified Table of Organizational Equipment
PLS	Palletized Load System
REBS	Rapidly Emplaced Bridge System
SBCT	Stryker Brigade Combat Team
TDA	Table of Distribution and Allowances
TRADOC	U.S. Army Training and Doctrine Command
UAS	Unmanned Aerial Sensor
UJTL	Universal Joint Task List
UXO	Unexploded Ordnance

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CHAPTER 1

INTRODUCTION

> Persistent conflict and change characterize the strategic environment. We have looked at the future and expect a future of protracted confrontation among state, non-state, and individual actors who will use violence to achieve political, religious, and other ideological ends. We will confront highly adaptive and intelligent adversaries who will exploit technology, information, and cultural differences to threaten U.S. interests. Operations in the future will be executed in complex environments and will range from peace engagement, to counterinsurgency, to major combat operations. This era of persistent conflict will result in high demand for Army forces and capabilities. (U.S. Army Posture Statement 2008)

Background

The U.S. Army has changed from a division-centric organization to a brigade combat team-centric organization with organic fire support and sustainment. Since 2003, these brigade combat teams (BCT) are more deployable, self-sustaining, and can conduct missions across the full spectrum of operations. FM 3-90.6, *The Brigade Combat Team,* outlines the doctrine and task organization of three different BCT designs: Infantry Brigade Combat Team (IBCT), Heavy Brigade Combat Team (HBCT), and Stryker Brigade Combat Team (SBCT). The current full spectrum doctrine outlined in FM 3-0, *Operations*, requires a BCT to simultaneously conduct a combination of offensive, defensive, stability, and civil support operations. All these operations are composed of complex tasks that require deliberate planning, technical expertise, specialized equipment, and experience of combat engineers. To complete these tasks, each BCT has an organic engineer company commanded by a captain.

Current stability operations in Iraq and Afghanistan highlight the demand, as well as the shortage of versatile engineers. Assuming we face persistent future conflict in the

next decade and with the substantial requirement for combat engineers across the full spectrum of operations, it is difficult to anticipate how the engineer staff and engineer company can adequately support all the immediate combat engineering functions in support of a BCT, to include mobility, countermobility, survivability, general engineering, and geospatial tasks.

The decisive operations for a BCT conducting an offensive operation require maneuver in order to conduct movement to contact, attack, pursuit, and exploitation. The combat engineers provide mobility support to the BCT by conducting gap crossing, obstacle reduction, and the improvement of combat roads and trails.

The decisive operations for a BCT conducting a defensive operation require massing fires to defeat or destroy the enemy. The BCT conducts area defense, mobile defense, or retrograde operations. The combat engineers provide survivability, countermobility, and mobility support to the BCT by conducting obstacle emplacement, preparing fighting positions, preparing survivability positions, gap crossing, obstacle reduction, and improvements to combat roads and trails for assured mobility of the BCT.

A BCT conducting stability operations must establish civil security, establish civil control, restore essential services, support governance, and support economic and infrastructure development. The BCT relies heavily on its combat engineers to conduct the engineer reconnaissance, infrastructure assessments, limited general engineering, and the supervision of construction contract execution by host nation construction assets.

The Army’s new doctrine as outlined in FM 3-0, *Operations*, states that a BCT should expect to conduct a combination of offense, defense, and stability operations

simultaneously, but where should the BCT commander focus the scarce engineer resources to achieve the desired effects without diluting their effectiveness?

Primary Research Question

Do the BCTs have sufficient organic engineer capability to conduct full spectrum operations in today's operational environment?

Secondary Research Questions

In order to answer the primary research question, these are the secondary research questions:

1. What are the engineer key tasks in support of a BCT conducting full spectrum operations?

2. What engineer key tasks can the BCT's organic engineer company execute simultaneously and sequentially?

3. What engineer key tasks in support of a BCT should Echelon Above Brigade (EAB) engineer units conduct?

4. Historically, what engineer capability was required to execute the identified engineer key tasks at the BCT level?

5. How much additional organic engineer capability can a BCT accept before exceeding its rapid deployability parameters?

Significance

The desired outcome of this thesis is a review of the capabilities required for successful engineer missions in support of a self-sufficient BCT. Combat engineers are multi-skilled, versatile Soldiers who can conduct a wide range of unique missions within

the full spectrum of operations. In order to adequately support BCT commanders, it is imperative that they receive the proper engineer capability. The recommendations proposed from this thesis could be used to add to, subtract from, or maintain the existing engineer structure organic to the BCT as outlined in the Modular Force design. Proposed recommendations could be implemented during the increase in Army end strength as a result of the Total Army Analysis and Grow the Army Campaign.

Assumptions

The current operational tempo and deployment cycles will continue at this current pace for at least the next ten years. There are specific, high probability missions that each BCT must be able to accomplish with its organic engineer assets. The comparison between today's BCT and Army of Excellence units will not be precise, but the tasks, missions, and operations will be similar. This study will focus only on BCTs conducting offense, defense, and stability operations. The author excluded civil support operations because these operations are conducted in the U.S. with any available military assets that can support civil authorities. The probability of a BCT conducting simultaneous offense, defense, and civil support operations is low. The force structure will not support organic engineer battalions within each BCT, so any recommendations will focus on optimizing and improving the combat engineer capabilities of the organic engineer companies.

Definitions

Assured Mobility. Framework of processes, actions, and capabilities that assures the ability of the joint force to deploy and maneuver where and when desired, without interruption or delay, to achieve the mission. This construct is one means of enabling a

joint force to achieve the commander's intent. Assured mobility emphasizes proactive mobility and countermobility actions and integrates all of the engineer functions in accomplishing this (JP 3-34 2007, III-8).

Combat Engineering. Those engineering capabilities and activities that support the maneuver of land combat forces and that require close support to those forces. Combat engineering consists of three types of capabilities and activities: mobility, countermobility, and survivability (JP 3-34 2007, I-3).

Core Capabilities Mission Essential Tasks (CCMET). A mission-essential task approved by Headquarters, Department of the Army, that is specific to the type of unit resourced according to its authorization document and doctrine (FM 7-0 2008, G-2).

Core Mission Essential Task List (CMETL). A list of a unit's core capability mission-essential tasks and general mission-essential tasks (FM 7-0 2008, G-2).

Directed Mission Essential Task List (DMETL). A list of mission-essential tasks that must be performed to accomplish a directed mission (FM 7-0 2008, G-2).

Full Spectrum Operations. Army forces combine offensive, defensive and stability or civil support operations simultaneously as part of an interdependent joint force to seize, retain, and exploit the initiative, accepting prudent risk to create opportunities to achieve decisive results. They employ synchronized action –lethal and nonlethal- proportional to the mission and informed by a thorough understanding of all variables of the operational environment. Mission command that convey intent and an appreciation of all aspects of the situation guides the adaptive use of U.S. Army forces (FM 3-0 2008, 3-1).

General Engineering. Those engineering capabilities and activities, other than combat engineering, that modify, maintain, or protect the physical environment. Examples include: the construction, repair, maintenance, and operation of infrastructure, facilities, lines of communication and bases; terrain modification and repair; and selected explosive hazard activities (JP 3-34 2007, I-3).

General Mission Essential Task (GMET). A mission-essential task approved by Headquarters, Department of the Army, that all units, regardless of type, must be able to accomplish (FM 7-0 2008, G-3).

Geospatial Engineering. Those engineering capabilities and activities that contribute to a clear understanding of the physical environment by providing geospatial information and services to commanders and staffs. Examples include: terrain analyses, terrain visualization, digitized terrain products, nonstandard tailored map products, precision survey, geospatial data management, baseline survey data, and force beddown analysis (JP 3-34 2007, I-3).

Limitations

There are numerous examples of engineer operations throughout history but this thesis will focus on those anticipated in support of a BCT conducting future full spectrum operations. The BCT must remain 100 percent mobile with organic vehicles. The Brigade Support Battalion (BSB) must remain 100 percent mobile with three combat loads for the BCT. These BCTs require 100 percent mobility of their Modified Table of Organizational Equipment (MTOE) authorized equipment to be transported in a single lift.

Delimitations

This thesis focuses primarily on the engineer capabilities organic to a BCT. This thesis will not address civil support operations executed in the U.S. This thesis will focus on the capabilities and will not estimate the costs for additional personnel, training, equipment, or facilities. This thesis will not address the specific training requirements for engineer officers, non-commissioned officers, and Soldiers. This thesis will not address the unique engineer unit training and certification process an engineer company commander must resource and supervise within the BCT. This thesis will not address the perceived gap between standard combat engineering, general engineering, and technical construction engineering skills in the officer corps.

Chapter 2 reviews the literature pertaining to current U.S. doctrine and recent articles that were used in the analysis of this thesis. These sources can guide future researchers on this topic. Chapter 3 describes the methodology the author used to analyze the hypothesis. In Chapter 4, the author analyzes the current BCT organizational structure in comparison to the full spectrum operational tasks. It then develops and compares courses of action. In conclusion, Chapter 5 will provide the conclusion and recommendation based on the analysis in Chapter 4.

CHAPTER 2

LITERATURE REVIEW

The primary research question asks if BCTs have sufficient organic engineer capability to conduct full spectrum operations in today's operational environment. This chapter reviews the literature pertaining to the doctrinal foundation for full spectrum operations which place stability operations as an equal to offense and defense operations, highlighted in the October 2008 version of FM 3-07, *Stability Operations*. This chapter also reviews the literature pertaining to BCT structure and the organic engineer capability. The end of the chapter describes the articles, research, and lessons learned related to this topic through recent operational experience in Iraq and Afghanistan.

Doctrinal Foundations

The *National Security Strategy* (*NSS*) and the National Security Presidential Directive 44 (NSPD-44) are the primary documents and set the foundation for the reconstruction and stability operations. NSPD-44 assigns the Department of State as the U.S. government lead for the interagency reconstruction and stabilization effort, and requires close coordination with the Department of Defense.

> The Secretaries of State and Defense will integrate stabilization and reconstruction contingency plans with military contingency plans when relevant and appropriate. The Secretaries of State and Defense will develop a general framework for fully coordinating stabilization and reconstruction activities and military operations at all levels where appropriate. (NSPD-44 2005, 1)

As a result of the *NSS* and NSPD-44, the Secretary of Defense issued DODD 3000.05, *Military Support for Stability, Security, Transition and Reconstruction*

Operations, which established stability operations as a core military mission; comparable to planning, preparing for, and executing combat operations.

> Stability operations are a core U.S. military mission that the Department of Defense shall be prepared to conduct and support. They shall be given priority comparable to combat operations and be explicitly addressed and integrated across all DOD activities including doctrine, organizations, training, education, exercises, materiel, leadership, personnel, facilities, and planning. (DODD 3000.05 2005, 1)

It clearly assigned military forces the responsibility for stability operations until the civilian representatives from the Department of State or the host nation are established and prepared to execute. The directive also defined the stability goals in two phases. The initial goals are to establish security, restore essential services, and meet the humanitarian needs of the local people. The long-term goal is to develop indigenous government capacity to provide for their people (DODD 3000.05 2005, 1).

Another key reference is Joint Publication 3-0, *Joint Operations,* which provides the fundamental principles and doctrine for the U.S. military across the range of all military operations. This reference identifies strategic and operational level tasks, and defines the importance of synchronized stability operations in order to reach the national strategic end state for successful campaign completion (JP 3-0 2006). JP 3-0 provides stability planning considerations targeted to the Joint Force Commander and staff which can apply at all levels. Although, the manual does not focus on the tactical tasks of a BCT, it sets the joint foundation.

FM 3-0, *Operations*, is one of the U.S. Army's principal doctrine manuals for full spectrum operations. It was published with full spectrum operations as the central theme. Full spectrum operations can be described as simultaneous stability operations directed at noncombatants while offensive and defensive operations are directed at the enemy. FM

3-0 continued the guidance that stability operations are equal in importance to offense and defense. It defined the primary tasks and purposes for elements of full spectrum operations. The author used the essential tasks defined in FM 3-0 for analysis at the BCT level.

FM 3-0 also highlighted the two other key qualities that are important for this thesis. The first was the U.S. Army's expeditionary capability to deploy forces rapidly at any time, to any environment, against any enemy. The second was its campaign capability to operate for extended periods of time between major combat to peace operations. Both of these capabilities are important to note because the BCT must retain its rapid deployability, but also possess the necessary assets to wage a campaign. The author of this thesis only analyzed the engineer tasks and assets, but there are other assets that could be optimized, but outside the scope of this thesis.

U.S. Army's FM 3-07, *Stability Operations,* discussed the primary tasks and purposes for stability operations in additional detail. This reference was updated and republished in the early stages of the author's analysis and served as the primary resource for essential stability tasks of a BCT and the anticipated roles of organic engineers within the BCT. The manual outlined three main phases of a stability operation: initial response phase, transformation phase, and sustainability phase.

During the initial phase military forces provide for the immediate needs of the populace and improve the security situation. The force must be adequately sized to seize the initiative and set the conditions in order to allow host nation and international civilian agencies and organizations to begin relief operations. As the basic building block for the military's response during the initial phase, the BCT must be adequately sized to

simultaneously provide security and address the immediate humanitarian needs of the host-nation people, especially where the situation prevents interagency personnel from acting. The military has the lead in the initial response phase to establish and maintain security in order to introduce civilian relief agencies for the next phases (FM 3-07 2008, 2-13).

The transformation phase begins when the military force maintains a relatively secure environment. A relatively stable environment allows host nation and international civilian agencies and organizations to lead the reconstruction and stabilization effort in order to rebuild host nation institutions and essential service capacity.

After the transformation phase, the sustainability phase includes the long term efforts to maintain sustainable economic development. The stable environment and rebuilt capacity allows the host nation to take greater responsibility during the sustainability phase. The military transitions almost complete responsibility to host nation or civilian control during the sustainability phase (FM 3-07 2008, 2-14).

The October 2007 final draft of FM 3-34, *Engineer Operations,* described engineer support to Army forces conducting full spectrum operations within the framework of joint operations. It is aligned with FM 3-0 and serves as the basis for all other engineer manuals. The author compared the essential tasks found in the draft FM 3-34 to those published in FM 3-0 and in FM 3-07 to gather additional detail from an engineer perspective. In the draft FM 3-34, notional applications for each engineer function were identified in full spectrum operations. FM 3-34.22, *Engineer Stability Operations Manual*, was also under development and unavailable during the author's research.

The above manuals served as the doctrinal foundation for the author's research, with FM 3-0 and FM 3-07 serving as the most important. The next part of this chapter will review the other literature available on this topic from recent articles, publications, research papers, and theses.

Current Trends

There are numerous publications about BCTs and the Future Engineer Force in relation to the Modular Force Design. There were several professional articles published since 2003, by the U.S. Army Engineer School in the magazine, *Engineer: The Professional Bulletin of Army Engineers*. The Center for Army Lessons Learned has also prepared relevant numerous reports and interviews, but they are classified at the For Official Use Only level. The author relied heavily on the Engineer School articles in order to maintain an unclassified thesis and reduce the publication restrictions. The current trend throughout the literature describes a shortage of engineers across the Army in order to execute the complex and varied mission requirements. The August 2006 version of FM 3-90.6 addressed the limited engineer capability within the BCT and recommended additional engineer battalion support to conduct any offensive, defensive, or stability operation.

Numerous students at the Army War College and the Command and General Staff College have researched the topic of engineer support to BCTs in recent years. In 2005, Major Michael Derosier wrote his School of Advanced Military Studies Monograph, *Assessing Engineer Transformational Concepts,* which studied past and present engineer organizations to determine the deficiency between engineering requirements and the capabilities within the BCT. He recommended that the Army increase the organic

engineer company to either an engineer battalion or an expanded company, based on available manpower assumptions at the time (Derosier 2005, 43). However, the 2009 National Defense Authorization Act authorizes an active duty Army end strength of 532,400 which may supersede his recommendation under a smaller end strength (National Defense Authorization Act of 2009, Section 401).

Major James Schultze's School of Advanced Military Studies Monograph, *Breaching the Phalanx: Developing a More Engineer-Centric Modular BCT,* argued that, in the current operational environment, stability operations are decisive and that engineer capability should be increased. He recommended that the Army employ more Maneuver Enhancement Brigades (MEB) as the most useful type of support brigade (Schultze 2007). Currently there are only two of the proposed total of four MEBs in the active Army, 1st MEB at Fort Polk, Louisiana activated in September 2007 and 4th MEB at Fort Leonard Wood, Missouri activated in September 2008. There is a small amount of research material on MEBs to describe their capabilities but insufficient to analyze their effectiveness.

Colonel Thomas O'Hara's, U.S. Army War College Class of 2008 thesis, *Engineer Support to Future Full-Spectrum Operations,* stated that the engineer company does not adequately support a BCT. He identified two main gaps in engineer support; the first was a shortage of engineer capability within the BCT and the second was over-specialization at the expense of multi-functional skills. He proposed three options to better support the BCT. The first, most preferred option, calls for the creation of an engineer battalion organic to the BCT, similar to Major Derosier's recommendation in 2005. Colonel O'Hara's second option re-designates the BCT's BSTB as an engineer

command with appropriate staff to lead the engineer, military intelligence, and signal companies. His third option would habitually assign an echelon above brigade engineer battalion to the BCT (O'Hara 2008, 21-24).

The doctrine references clearly establish the significance and requirement to conduct stability operations equal to and simultaneously with offensive and defensive operations. While the other studies identify a shortage of engineer capability within the BCT in broad terms, they do not fully address the engineer capabilities and requirements within the BCT in terms of personnel and equipment necessary to accomplish engineer tasks in this era of persistent conflict.

The previous chapter established the primary and secondary research questions. This chapter reviewed the available research material, literature, and current trends of thought related to the topic. The next chapter will present the methodology used by the author to research this thesis.

CHAPTER 3

RESEARCH METHODOLOGY

> The sappers of the Victory Corps were all over the battlespace, providing value wherever they were employed . . . river crossing operations, building and maintaining infrastructure, conducting stability and support operations, repairing airfields, conducting combat operations--and much, much more . . . all done to an exceptionally high standard . . . each member of this high-energy team is a national hero.
>
> — Lieutenant General William S. Wallace
> Former Commanding General, V (U.S.) Corps

Method

The previous chapter reviewed the pertinent literature and this chapter will describe the research methodology the author used in Chapter 4 to seek answers to the primary and secondary research questions. The primary research question asks if BCTs have sufficient organic engineer capability to conduct full spectrum operations in today's operational environment. The secondary research questions are: What are the engineer key tasks in support of a BCT conducting full spectrum operations? What engineer key tasks can the BCT's organic engineer company execute simultaneously and sequentially? What engineer key tasks in support of a BCT should Echelon Above Brigade (EAB) engineer units conduct? Historically, what engineer capability was required to execute the identified engineer key tasks at the BCT level? How much additional organic engineer capability can a BCT accept before exceeding its strategic deployability parameters?

The research question and the available data determine the research method. The primary and secondary research questions were identified above and in Chapter 1. Now we must identify the available data in order to determine the most appropriate research methodology. In his book, *Practical Research Planning and Design*, Paul Leedy

describes four kinds of data: historical data, descriptive data, analytical data, and experimental data. The majority of available data dictates which one of four broad categories of research methodology is the most appropriate (Leedy 1985, 88).

Historical data consists of written records, journals, and accounts of past events. Historical data is qualitative in nature and is the appropriate methodology for understanding historical data. The purpose is to observe and interpret interactions among people, historical events, and their environment by reconstructing the past experience as accurately as possible from existing historical records. Researchers rely on primary historical data to achieve the required accuracy through the use of personal records, journals, letters, and other accounts. Primary historical data is the critical component to the proper use of the historical methodology (Leedy 1985, 126). In the context of this research, accounts of engineer activities in previous BCT deployments are examples of historical data.

Descriptive survey data includes direct observations made by the researcher. Descriptive survey data is qualitative in nature because it is conveyed by words, observations, and interpretations. However, unlike historical data, descriptive survey data is actively observed and recorded. Therefore, descriptive survey method is the appropriate method for dealing with data observed and documented by the researcher. The researcher gathers specific data relevant to the research questions through the use of surveys, interviews, or even case studies. A defined sampling population, clear parameters, and standardization are critical components for minimizing bias and distortion of results in the descriptive survey method (Leedy 1985, 142). In the context of

this research, examples of the descriptive survey data are the current CMETL, DMETL, and training strategies for the BCTs.

Analytical survey data is a type of quantitative data. Quantitative data are measurements, calculations, and numerical data. Analytical survey data are observations determined numerically through frequency, statistics, and mathematics. The analytical survey method is the name for the research method and uses statistics to estimate, predict, and identify correlations of numerical data. Statistical analysis is the main tool available to the researcher for describing the meaning and interrelationships between quantitative analytical survey data in this method (Leedy 1985, 183).

Experimental data are observations made by comparing and contrasting multiple similar circumstances based on different conditions or over time. The experimental method, another quantitative method, attempts to identify cause and effect. It is conducted by comparing similar situations, introducing variables until a change is observed and measured. Statistical analysis is used to analyze the quantitative data to determine the extent of cause and effect (Leedy 1985, 218).

Given the four broad categories of research methodologies and the principle method dictated by available data, the author identified the descriptive survey method, with some application of historical data, as the most appropriate method for this thesis. The preponderance of data fell within the qualitative category because of the necessity for substantial interpretation by the author and the reliance on observation data related to past and ongoing operations in Iraq and Afghanistan. Case studies and field studies are subcategories within the historical and descriptive survey methods and applied to this thesis.

Analytical Framework

As discussed in Chapter 2, the first step was to review the current state of thought on the topic written in materials pertaining to this thesis in order to establish a strong foundation. The next step was to review the established doctrinal guidance from the national level policy documents down to the U.S. Army Field Manuals to enhance the understanding. With this doctrinal understanding, it was important to gain insight into the design and purpose for the development of three different types of modular BCTs. Although each BCT was designed to conduct full spectrum operations, each BCT has advantages and disadvantages in relation to the operational environment.

The Heavy Brigade Combat Team (HBCT), as shown in Figure 1, has armored and mechanized units equipped with M1A2 main battle tanks, M2A3 infantry fighting vehicles, and M109A6 self-propelled artillery. The total personnel strength is approximately 3,800 Soldiers, organized into two combined arms battalions (CAB), one reconnaissance squadron, one fires battalion, one brigade support battalion (BSB), and one brigade special troops battalion (BSTB) (FM 3-0 2008, C-6). The core mission of the HBCT is to disrupt or destroy enemy military forces, control land areas including populations and resources and be prepared to conduct combat operations to protect U.S. national interests (FMSWeb 2009).

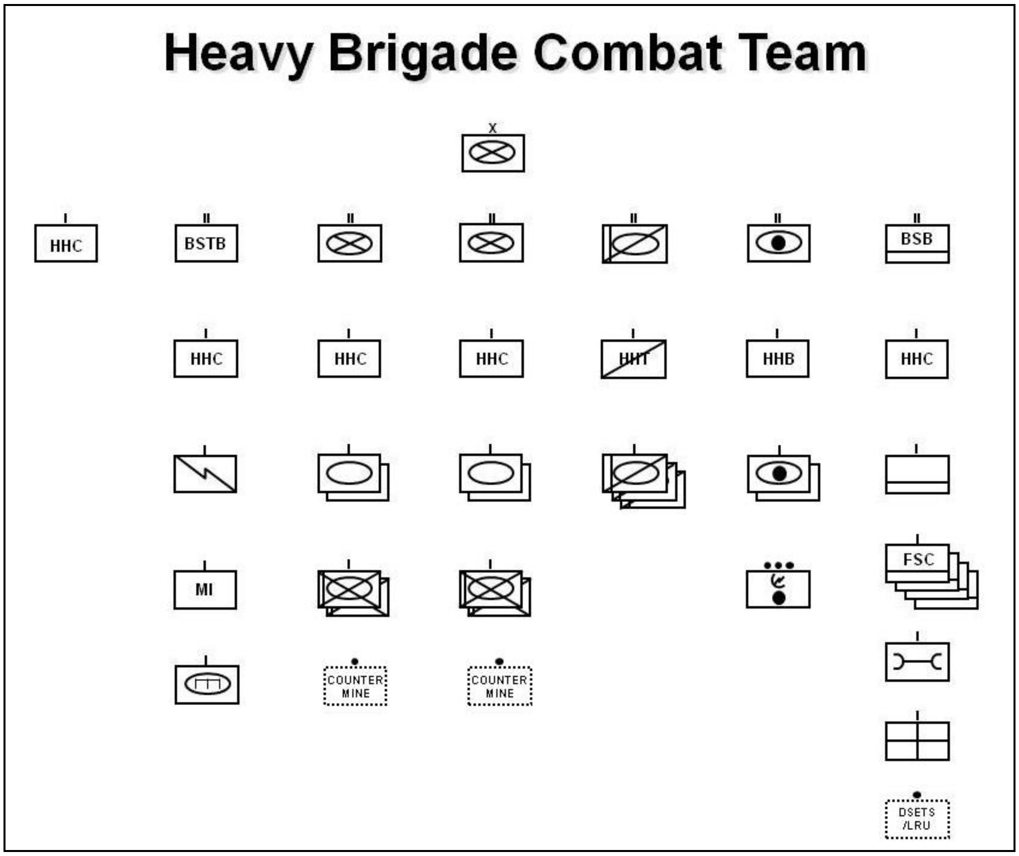

Figure 1. HBCT Task Organization (Second Generation)
Source: U.S. Army, FKSM 71-8, *Armor/Cavalry Reference Data: Brigade Combat Teams* (Fort Knox, KY: Government Printing Office, 2006), Annex A.

The strengths of the HBCT are its mobility, protected firepower, and ability to conduct sustained operations. At the time of this research, many HBCTs were based on the original design which had an organic engineer company assigned to each of its two CABs. A new HBCT design consolidates both engineer companies into one company and assigns it to the BSTB. The HBCT's mobility is restricted by dense forests, mountainous and urban terrain. It has no organic gap crossing assets. The HBCT footprint and logistics consumption rate is the greatest of the BCTs. Currently, the stability operations and

counterinsurgency operations in Iraq and Afghanistan tend to be more focused on dismounted and wheeled forces (FM 3-90.6 2006, A-3).

The Infantry Brigade Combat Team (IBCT), as shown in Figure 2, is the lightest BCT with the primary combat power derived from dismounted infantry. The total personnel strength is approximately 3,400 Soldiers, organized into two infantry battalions, one reconnaissance squadron, one fires battalion, one BSB, and one BSTB (FM 3-0 2008, C-6). The core mission of the IBCT is to disrupt or destroy enemy military forces, control land areas including populations and resources and be prepared to conduct combat operations to protect U.S. national interests (FMSWeb 2009). IBCTs close with and destroy the enemy by means of fire and maneuver to defeat or capture him, or to repel his assault by fire, close combat, and counterattack (FM 3-0 2008, C-6).

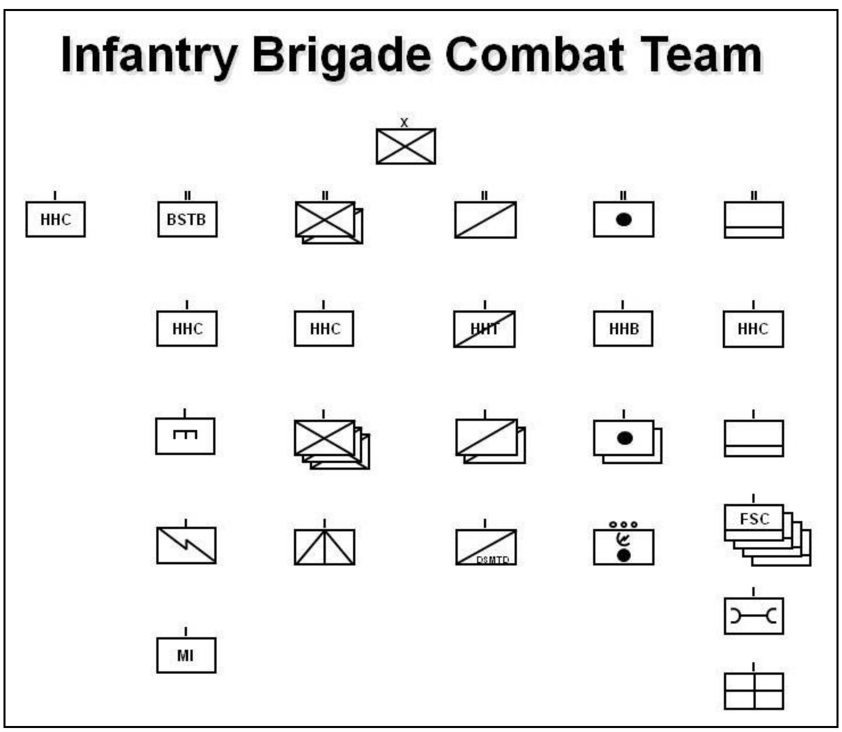

Figure 2.   IBCT Engineer Task Organization
Source: U.S. Army, FKSM 71-8, *Armor/Cavalry Reference Data: Brigade Combat Teams* (Fort Knox, KY: Government Printing Office April 2006), Annex A.

The IBCT is the best suited for small unit operations in densely populated areas or rugged, severely restrictive terrain. It is rapidly deployable with the fewest strategic lift assets, able to conduct forced entry, and requires the least resources to sustain. The IBCT has one organic engineer company in its BSTB, but no organic gap crossing assets. The IBCT does not have the mobility, firepower, or protection of the HBCT or the SBCT. Limited transportation assets reduce the IBCT's tactical movement speed and range. Dismounted movement is their primary means of maneuver (FM 3-90.6 2006, A-6).

The Stryker Brigade Combat Team (SBCT), as shown in Figure 3, was designed around the Stryker wheeled armored combat vehicle for greater mobility and firepower than the IBCT, but easier to deploy and sustain than the HBCT. The total personnel strength is approximately 4,000 Soldiers organized into three infantry battalions, one reconnaissance squadron, one fires battalion, one BSB, one signal company, one military intelligence company, one anti-tank company, and one engineer company (FM 3-0 2008, C-7). The SBCT's organic engineer company is a separate company and does not fall under a BSTB or maneuver battalion like the IBCT and HBCT. The core mission of the SBCT is to disrupt or destroy enemy military forces, control land areas including populations and resources and be prepared to conduct combat operations to protect U.S. national interests (FMSWeb 2009). SBCTs deploy worldwide to conduct full spectrum operations, use mobility, firepower, and protection to close with and destroy the enemy by means of fire and maneuver to defeat or capture him, or to repel his assault by fire, close combat, and counterattack (FM 3-0 2008, C-7).

The SBCT has three maneuver battalions compared to only two in the IBCT and HBCT. It has greater mobility, firepower, and protection than the IBCT, and takes less

sustainment than the HBCT. Unlike the IBCT and HBCT engineers, the SBCT's organic engineer company has gap crossing assets. The SBCT lacks the firepower and protection of an HBCT and needs more strategic lift assets to deploy than the IBCT. The SBCT does not have a BSTB to command and control the brigade's enablers and the BSB does not have forward support companies (FSC) for each battalion (FM 3-90.6 2006, A-9). With a limited number of six Regular Army SBCTs and one National Guard SBCT, these flexible and capable units will be in high demand (FMI 3-0.1 2008, 1-2).

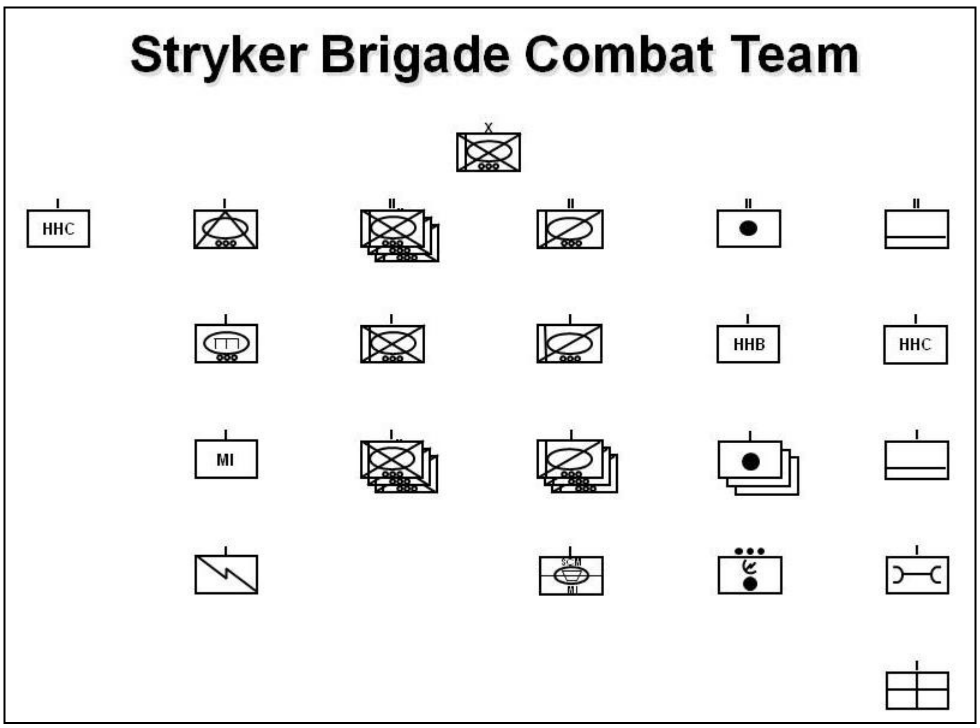

Figure 3. SBCT Task Organization
Source: U.S. Army, FKSM 71-8, *Armor/Cavalry Reference Data: Brigade Combat Teams* (Fort Knox, KY: Government Printing Office April 2006), Annex A.

Once the BCT missions and employment considerations were explained, it was important to identify the organic engineer assets within each of these different BCT

types. Each BCT design contains a different mix of assets and capabilities for conducting functional engineer missions in mobility, survivability, countermobility, general engineering, and geospatial support. In order to conduct analysis or make change recommendations, the current engineer assets must be clearly identified.

The author used the Force Management System Web Site (FMSWeb), managed by the U.S. Army Force Management Support Agency, to obtain the engineer capabilities organic within SBCT, IBCT, and HBCT units. FMSWeb is a web-based program that serves as the primary data source for Headquarters, Department of the U.S. Army approved authorization documents like the table of organization and equipment (TOE), modified table of organization and equipment (MTOE), table of distribution and allowances (TDA), and common table of allowances (CTA). These authorization documents specify the number of personnel by rank, grade, occupational specialty, and special skill allowed in each unit type. They also define the amount and type of equipment by line item number (LIN), national stock number (NSN), and equipment readiness code (ERC) allowed in each unit type (FMSWeb 2009).

The author arranged the data from FMSWeb with a spreadsheet program depicting all the engineer personnel positions and any branch immaterial positions which could potentially be filled by engineer Soldiers. On a separate spreadsheet, the author identified and arranged the major items of engineer equipment, categorized by equipment readiness codes of ERC A and P. These major items of equipment are necessary to conduct engineer operations and were grouped into the functional areas of mobility, survivability, countermobility, general engineering, and geospatial support. This

arrangement of data allowed the author to compare and contrast the existing engineer capability as specified by the units' authorization documents and primary source data.

The next step was to find the primary source data supporting mission essential task list (METL) for each BCT type. A METL is a group of directed tasks that must be performed to successfully complete to accomplish the unit's doctrinal mission, and each BCT has a specific doctrinal mission. FM 7-0, *Training for Full Spectrum Operations,* outlined the method the author used to gather the data supporting the mission essential tasks. The research started with the Universal Joint Task List (UJTL) and the Joint Mission Essential Task List (JMETL), which must be approved by a Joint Force Commander. These high level task lists provided a broad overview but were not the primary source for the author's analysis at the BCT level. Next the author shifted focus to the Core Mission Essential Task List (CMETL) which are standardized at the brigade level and above to specifically assign the essential tasks according to the unit's mission and authorization document. The CMETL standardizes all the tasks that Joint and Army Commanders expect subordinate unit types to successfully complete to accomplish their missions (FM 7-0 2008, 4-8).

The CMETL tasks are found in the Combined Arms Training Strategy (CATS) based on the unit's type and authorization document number. The author downloaded the CMETL training strategies for each BCT and organic engineer unit in order to compare and contrast the essential tasks and foundation for the missions the BCT engineers were expected to accomplish doctrinally in support of full spectrum operations (U.S. Army Digital Training Library 2009). These CMETL training strategies served as the primary source data for the minimum required tasks to accomplish.

Next the author gathered data on the actual BCT engineer tasks that were prevalent on deployments to Iraq and Afghanistan that may or may not have been captured in the unit's CMETL. This method was similar to the Directed Mission Essential Task List (DMETL) concept in FM 7-0, *Training for Full Spectrum Operations*. The author identified those high probability tasks that units reported conducting in support of operations that were or could have been done by organic engineer assets as found in recent reports, articles, Combined Arms Lessons Learned pamphlets, and interviews with other engineers. This list of high probability engineer tasks, in addition to the standardized CMETL, became the evaluation criteria used to compare the proposed courses of action for engineer asset reallocation and redesign in BCTs for full spectrum operations.

The author developed three different organic engineer configuration courses of actions for analysis and comparison against these high probability engineer tasks accomplished by each BCT type. The first course of action involved no changes to the current engineer and BCT structure. The second course of action involved a medium augmentation of organic engineer personnel and equipment to accomplish a given percentage of the high probability BCT missions. The third course of action involved a large augmentation of organic engineer personnel and equipment to accomplish more of the high probability BCT missions. This analysis was conducted separately for each type of BCT to determine capability gaps and whether or not the courses of action addressed these gaps.

Based on the analysis and comparison, the author drew conclusions for the primary and secondary research questions. The author proposed additions to the CMETL

tasks from the DMETL tasks that were most frequently identified. The perceived capability gaps were analyzed and potential solutions were recommended. However, the BCT size and mobility constraints were a critical consideration when trying to add personnel and equipment.

The author used the historical and descriptive survey methods, due to the preponderance of qualitative data, in order to develop answers to the research questions in this thesis. The observations gathered from recent articles, reports, lessons learned, and interviews were the principal data collection method. Engineer missions in support of BCTs in Iraq and Afghanistan established the selection criteria for data inclusion in this thesis. The author developed an organized system to record and present the data. The approach attempted to minimize bias and distortion in processing these data, thus allowing for more accurate conclusions to be developed from the analysis (Leedy 1985, 142).

CHAPTER 4

ANALYSIS

> The one BOS that has been consistently critical at every phase of the campaign--from the border obstacle breach, all the way through the attack, to current stability and support operations--and has performed superbly and come through big time for the Corps at every turn . . . has been the engineers. . . . The engineers have been the most flexible, versatile, multipurpose, and important force--from start to finish--in the campaign.
>
> — Major General Walt Wojdakowski
> Former Deputy Commanding General, V (U.S.) Corps

The purpose of this chapter is to apply and demonstrate the descriptive study research methodology, informed by historical data described in Chapter 3, to determine if BCTs have sufficient organic engineer capability to conduct full spectrum operations in today's operational environment. This chapter is divided into three main sections. The first section begins with an outline of the engineer task organization and assets organic to each BCT. This section seeks to answer secondary research question (4) what engineer capability was required to execute the identified engineer key tasks at the BCT level? The second section of this chapter focuses on the engineer tasks. It identifies the CMETL approved by HQDA and highlights the DMETL tasks compiled by the author's research of engineer tasks in Iraq and Afghanistan. This section answers the secondary questions of: (1) what are the engineer key tasks in support of a BCT conducting full spectrum operations, (2) which engineer key tasks can the BCT's organic engineer company execute simultaneously and sequentially, and (3) what engineer key tasks in support of a BCT should Echelon above Brigade (EAB) engineer units conduct? The third and final section of this chapter develops, analyzes, and compares three courses of action to optimize the organic engineer capability in the BCTs, and addresses secondary question

(5) how much additional organic engineer capability can a BCT accept before exceeding its deployability parameters?

Engineer Assets in the BCTs

HBCT Engineers

The stated mission of the HBCT engineer company is “to increase the combat effectiveness of the maneuver commander by accomplishing mobility and countermobility, as well as limited survivability, and general engineering tasks” (FMS Web 2009). This mission statement acknowledges the HBCT engineer company’s limitations for survivability and general engineering tasks, but expects the company to accomplish mobility and countermobility tasks in support of the HBCT.

The HBCT has more engineers when compared to other BCTs and they are assigned to multiple sections throughout the HBCT. The HBCT headquarters has two majors and a reconnaissance NCO on the brigade staff, and one captain, two NCOs, and three enlisted Soldiers in the terrain team, for a total of nine engineer coded positions in the brigade headquarters. The initial HBCT design assigned each CAB a task force engineer captain and a reconnaissance sergeant on the battalion staff, and a seventy-six Soldier engineer company for support. The objective design consolidates the two CAB engineer companies into one HBCT company (MTOE 05303G200) assigned to the BSTB. This consolidated engineer company is comprised of six officers and one hundred forty-five enlisted engineers for a total of one hundred and fifty-one Soldiers in the company. It is organized with a headquarters section, three sapper platoons, and an obstacle platoon, as shown in Figure 4.

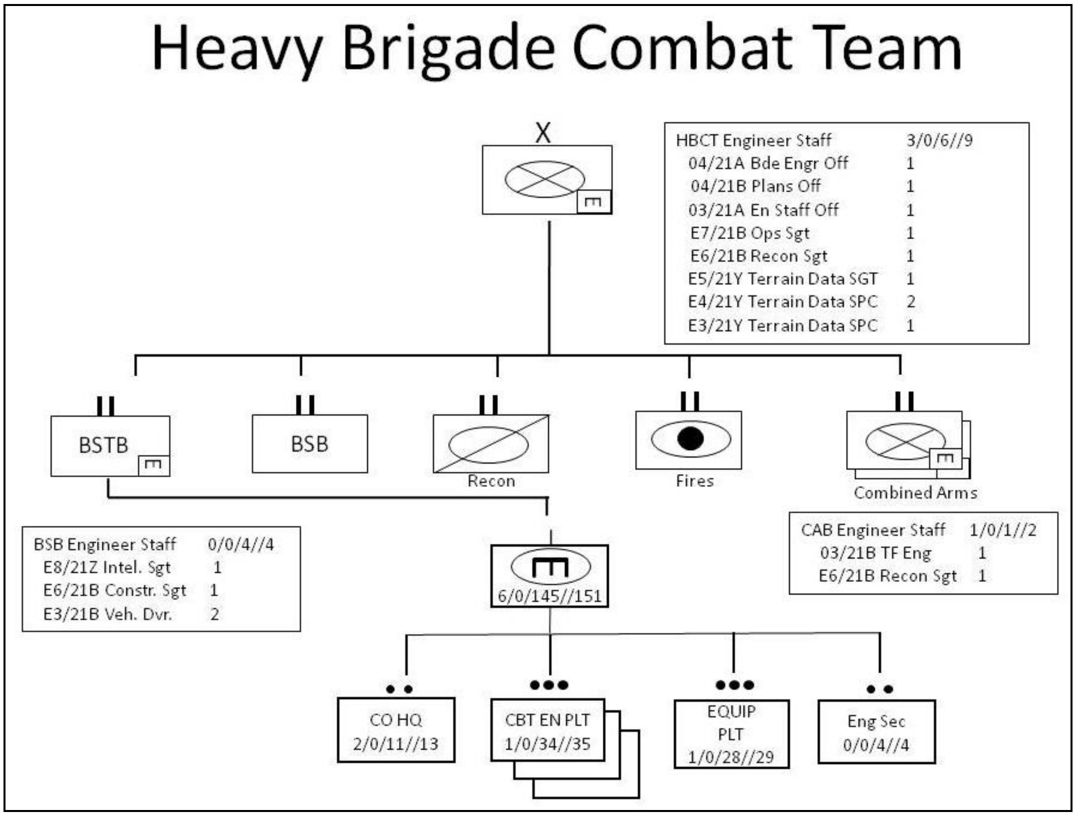

Figure 4. HBCT Engineer Company Task Organization (Second Generation)
Source: U.S. Army, FMS Web, https://fmsweb.army.mil (accessed 9 January 2009).

The BSTB in the current HBCT design has a construction operations NCO and two enlisted engineers as vehicle drivers. The BSTB commander, command sergeant major, executive officer and operations officer are all coded as branch immaterial and could potentially be additional engineers. The grand total of all engineer coded positions throughout the objective HBCT is one hundred and sixty-eight Soldiers (FMSWeb 2009). As a comparison, an infantry company in the CAB is authorized one hundred and thirty-five Soldiers. This total is a significant reduction from the Army of Excellence (AOE) or Force XXI structure’s engineer battalion which consisted of a headquarters company, three engineer companies, and totaled over four hundred engineer Soldiers to support a heavy brigade.

With respect to engineer equipment capabilities, the HBCT headquarters is authorized a Digital Topographic Support System-Light (DTSS-Light) for the terrain team. This system is capable of receiving, creating, updating, storing, retrieving, and managing digital topographic data, then processing into hardcopy and softcopy topographic products (DTSS Fact Sheet 2003, 1). The rest of the engineer equipment is found in the HBCT engineer company. The primary pieces of equipment in the objective HBCT engineer company are thirteen M2 Bradley Fighting Vehicles, six Assault Breaching Vehicles (ABV), six M9 Armored Combat Earthmovers (ACE), three High Mobility Emplacement Excavators (HMEE), and thirty-eight AN/PSS-14 handheld standoff mine detection systems (HSTAMID) to support the HBCT (FMSWeb 2009). The six ABVs, built on the M1 tank chassis, greatly increased the HBCT engineer company's mounted breach capability, but the company lost the armored vehicle launched bridges (AVLB) for assault gap crossings that were available in the Force XXI design. The HBCT engineer company also gained more capable squad vehicles and the HBCT gained additional firepower when the company changed from M113s to M2 Bradleys.

IBCT Engineers

The IBCT engineer company's stated mission is "to increase the combat effectiveness of the separate BCT by accomplishing limited mobility, countermobility, survivability, and sustainment engineering missions, or to perform infantry combat missions when required" (FMSWeb 2009). This mission statement acknowledges that the company is equipped for "limited" support to all combat engineer functions.

Although the IBCT has fewer total organic engineers, the IBCT staff engineer positions are the same with a brigade engineer major; a major in the plans section; a captain, two NCOs, and three enlisted Soldiers in the terrain team; and a reconnaissance sergeant for a total of nine engineer coded positions in the brigade headquarters (FMSWeb 2009). Each Infantry battalion headquarters has only one engineer position, the reconnaissance NCO, but the RS does not have any engineer positions. Another major difference with respect to engineer personnel between the IBCT and the HBCT is the fact that the engineer company has only two sapper platoons and an equipment section in the IBCT, as shown in Figure 5.

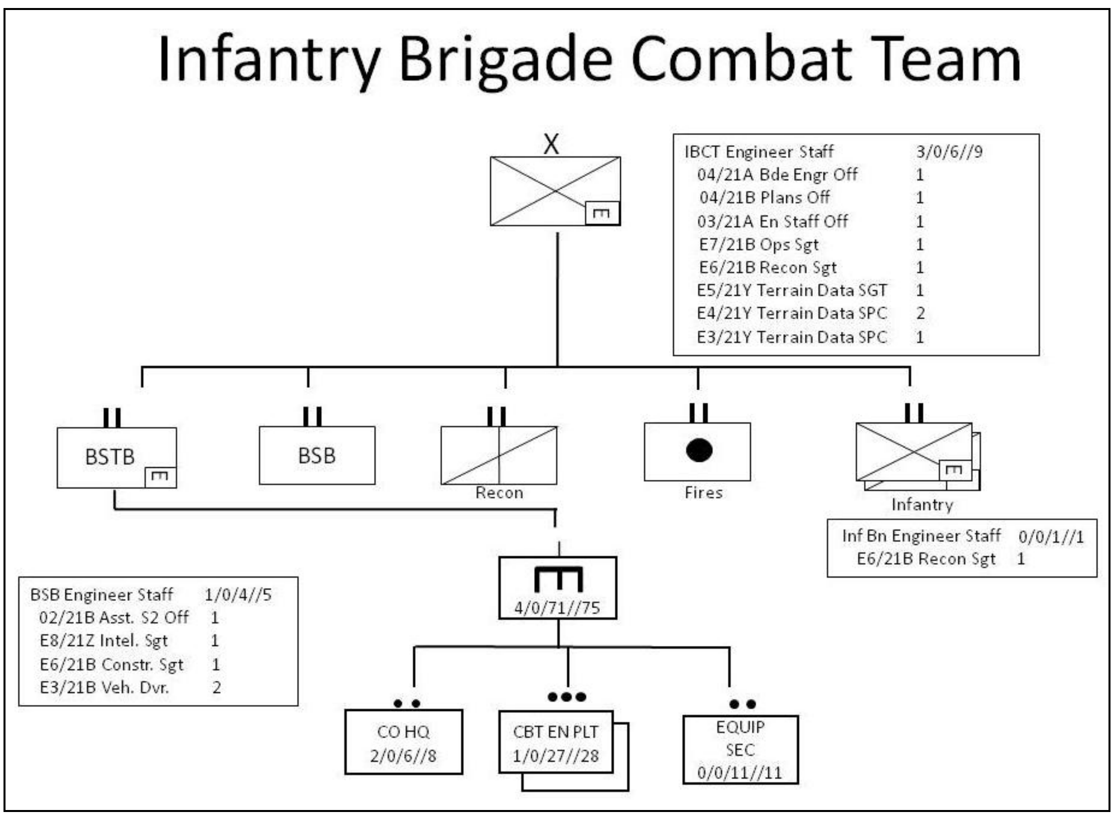

Figure 5. IBCT Engineer Task Organization
Source: U.S. Army, FKSM 71-8, *Armor/Cavalry Reference Data: Brigade Combat Teams* (Fort Knox, KY: Government Printing Office 2008), Annex B.

Like the objective HBCT design, the IBCT assigns the engineer company to the BSTB. The company is comprised of four officers and seventy-one enlisted Soldiers for a total of seventy-five personnel. The engineer company is organized with a headquarters section, an equipment section, and two sapper platoons with a total of six available sapper squads. In addition to the engineer company, the BSTB has an assistant intelligence officer, intelligence NCO, a construction operations NCO and two enlisted engineers as vehicle drivers. Like the HBCT design, the BSTB commander, command sergeant major, executive officer, and operations officer are all coded as branch immaterial and could potentially be additional engineers. The grand total of all engineer coded positions throughout the IBCT is ninety-one Soldiers (FMSWeb 2009). This total is similar to the Force XXI's structure of an engineer company of two or three engineer platoons to support a light infantry brigade.

The IBCT is authorized a DTSS-Light for the headquarters terrain team to receive, create, and produce geospatial products for the IBCT. The IBCT's combat power is derived from its dismounted infantry and does not have a large percentage of motorized equipment to conduct its mission. In comparison to the rest of the IBCT, the engineer company has a considerable amount of equipment. The primary pieces of engineer equipment are: one 2.5 cubic yard bucket loader, four HMEEs, two deployable universal light earthmovers (DEUCE), three Bobcat skid steer tractors, twelve HMMWVs, two dump trucks, two flat bed tractor trailer combinations, twelve AN/PSS-14 HSTAMIDs, six demolition kits, six pioneer tool kits, and six M240B machineguns to support the IBCT (FMSWeb 2009). Except for modern equipment models, the IBCT engineer

company authorization has not changed much from the Army of Excellence or Force XXI design.

SBCT Engineers

The stated mission of the SBCT engineer company is to provide organic mobility, force protection, limited countermobility, survivability, and sustainment engineering to the BCT (FMSWeb 2009). This mission statement expect the SBCT engineer company to accomplish mobility and force protection tasks in support of the SBCT, but acknowledges its limitations in countermobility, survivability and sustainment engineering tasks.

The SBCT headquarters has a brigade engineer major; a captain in the plans section; one geospatial information warrant officer, three NCOs, and two enlisted Soldiers in the terrain team for a total of eight engineer coded positions in the brigade headquarters. The SBCT and subordinate battalion headquarters do not have a reconnaissance NCOs assigned and the battalion headquarters do not have a task force engineer officer assigned. There are no BSTBs, so the current design assigns one engineer to the SBCT as a separate company, as shown in Figure 6. The separate engineer company is comprised of six officers and one hundred thirty-seven enlisted Soldiers for a total of one hundred forty-three personnel. The SBCT engineer company has a headquarters platoon, three combat mobility platoons with nine sapper squads, and one mobility support platoon with three mobility sections. The grand total of all engineer coded positions throughout the SBCT is one hundred and fifty-one Soldiers (FMSWeb 2009).

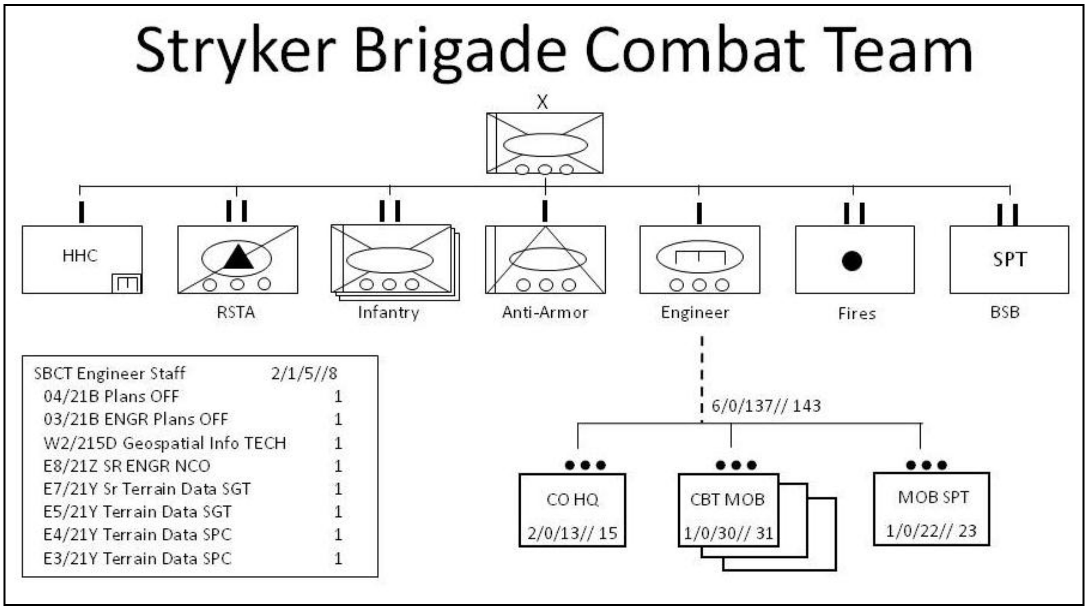

Figure 6. SBCT Engineer Company Task Organization
Source: U.S. Army, FKSM 71-8, *Armor/Cavalry Reference Data: Brigade Combat Teams* (Fort Knox, KY: Government Printing Office 2008April 2008), Annex C.

Like the other BCTs, the SBCT headquarters has a terrain team equipped with the DTSS-Light system to receive, create, and produce geospatial products for the SBCT. The rest of the SBCT engineer equipment is located in the engineer company. The primary pieces of equipment in the SBCT engineer company are: twelve Stryker Engineer Squad Vehicles, one Stryker Infantry Fighting Vehicle, nine mine clearing rollers, three mine clearing plows, three volcano mine systems, six Mongoose MICLIC trailers, six HMEEs, six DEUCEs, one Bobcat skid steer tractor, four rapidly emplaced bridge systems (REBS), six HEMTTs with PLS trailers, nine demolition kits, and twenty-six AN/PSS-14 HSTAMIDs to support the SBCT (FMSWeb 2009). The SBCT is the only BCT with organic bridging systems.

The main mobility assets in the company are engineer squads equipped with Stryker squad vehicles, plows, rollers, and MICLIC trailers. These squads can execute mounted breaches with the plows, rollers, and MICLICs or dismounted breaches with HSTAMIDS, demolition sets, and pioneer tools to increase the mobility of the SBCT. The mobility sections have the bridges and heavy equipment to support vehicle movement. The REBS organic bridging system spans a gap of forty-two feet and can support vehicle weights up to fifty tons. This system provides a significant vehicle mobility capability not organic to the other BCTs.

Summarizing, each type of BCT has a different structure and different equipment in its organic engineer units. These companies are a small percentage of the BCT end strength and seem to lack critical equipment for supporting assured mobility. Any substantial engineer requirement in mobility, countermobility, survivability, or general engineering will likely exceed their capability and will require augmentation from the engineer force pool.

CMETL and DMETL of the BCTs

As defined in Chapter 3, the CMETL is an approved list of general and core capability tasks that each organization was designed to perform based on its mission, MTOE, and doctrine. The CMETL is standardized for each unit type, for example all HBCTs were designed to accomplish the same CMETL tasks. This standardization also guides the training strategy for the BCT commander and staff in preparation for broad mission requirements in the full spectrum of operations.

The HBCT CMETL, as shown below in Figure 7, clearly defines the general tasks and the core capability tasks of the HBCT. All the BCT designs have the same general

tasks of conducting command and control, protecting the force, and providing sustainment. In full spectrum operations, units are likely to conduct these tasks to different degrees simultaneously across their area of operations.

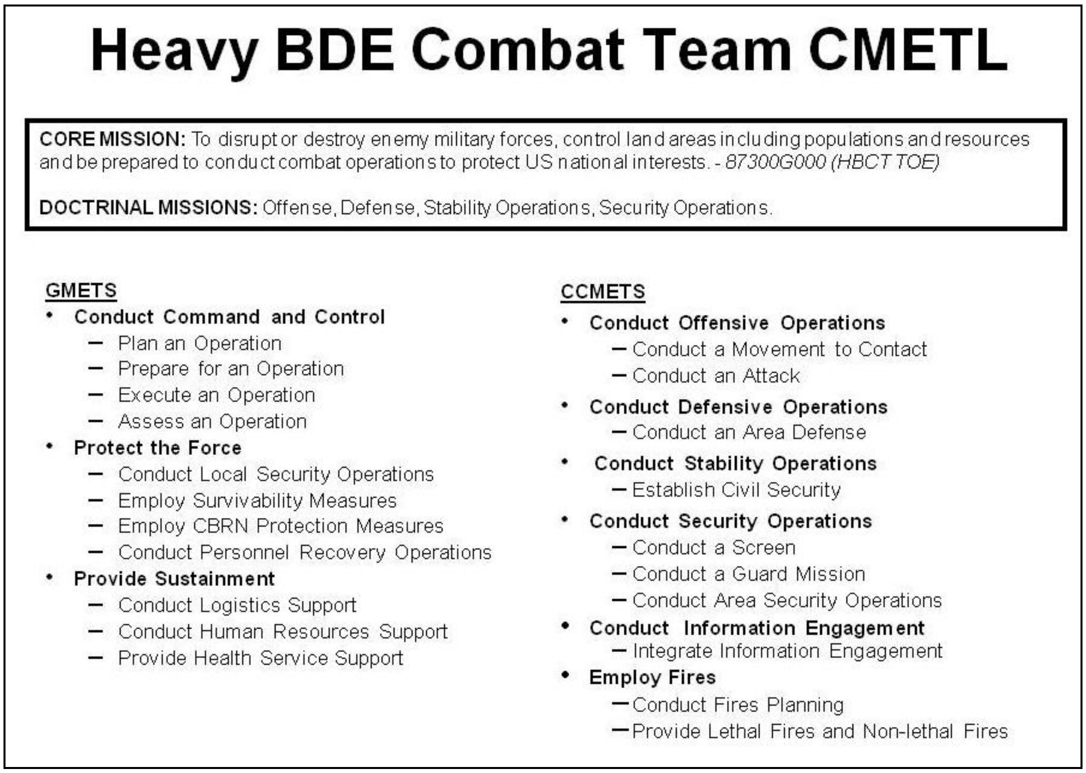

Figure 7. HBCT CMETL
Source: HQDA G-3/5/7 Approved CMETL presentation to Combined Arms Center, Fort Leavenworth, Kansas, 17 December 2008.

The IBCT CMETL, as shown in Figure 8, is almost identical to the HBCT except for the requirement to conduct an air assault. Airborne brigades have an additional CMETL task of conducting airborne assaults.

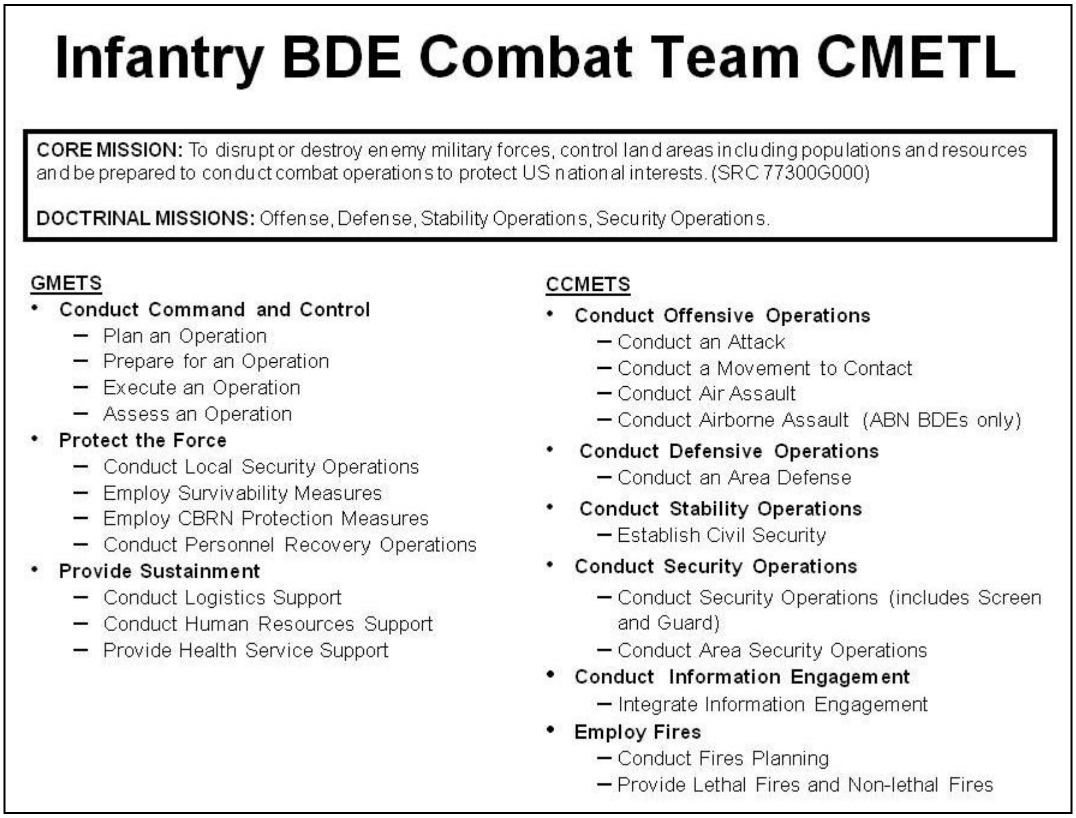

Figure 8. IBCT CMETL
Source: HQDA G-3/5/7 Approved CMETL presentation to Combined Arms Center, Fort Leavenworth, Kansas, 17 December 2008.

The SBCT CMETL, as shown in Figure 9, is the similar to the IBCT with the exception of conducting airborne assaults.

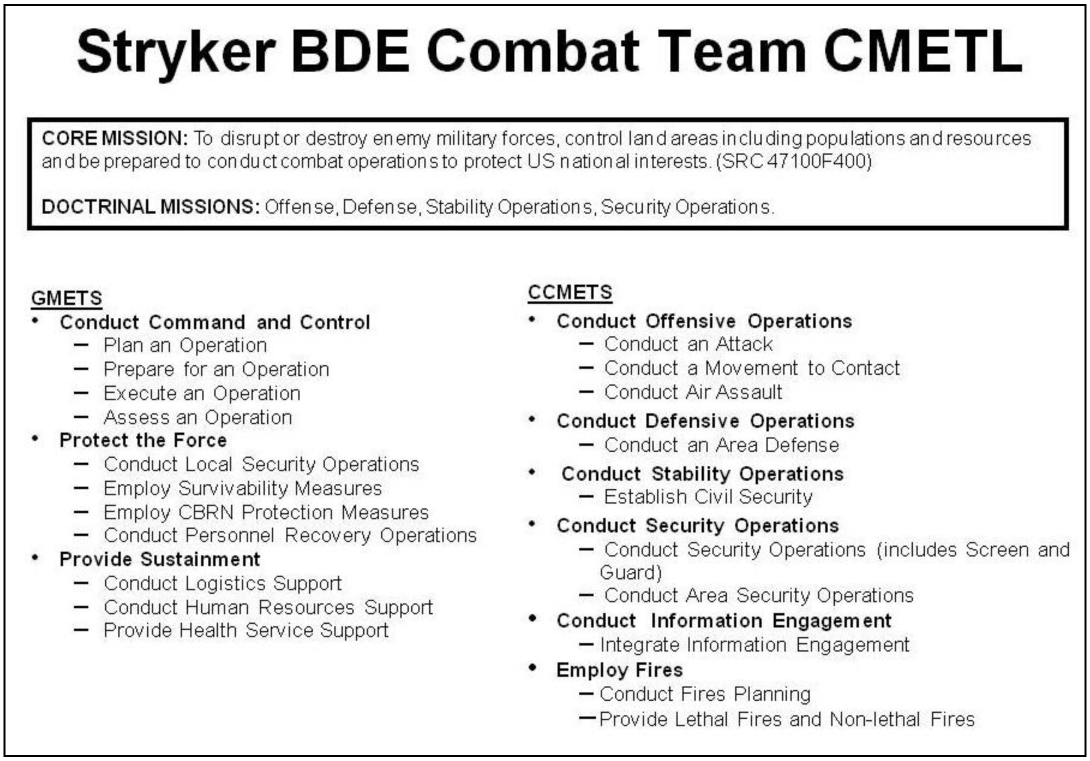

Figure 9. SBCT CMETL

Source: HQDA G-3/5/7 Approved CMETL presentation to Combined Arms Center, Fort Leavenworth, Kansas, 17 December 2008.

As defined in Chapter 3, the DMETL is an approved list of tasks based on the anticipated operational environment of an upcoming mission or deployment. The DMETL is more focused and combines the commander's guidance with specific operational tasks to accomplish a specified mission. The intent is to narrow the focus of the training strategy and train the essential tasks to accomplish the specified mission. The author identified engineer related DMETL tasks in support of full spectrum operations in Iraq and Afghanistan.

The U.S. Army units under V Corps during Operation Iraqi Freedom and the invasion of Iraq in 2003 were based on the Army of Excellence and Force XXI designs.

Unit METL and Battle Focused Training were the constructs of the time because the training concepts of CMETL and DMETL had not yet been formalized and implemented. For this reason, the author used articles written by combat commanders to determine the actual engineer tasks for the DMETL in this thesis. The former 130th Engineer Brigade Commander and V Corps Engineer, Gregg F. Martin, published two professional articles about engineer missions in Iraq that ranged from the major combat operations of the invasion through the transition to stability operations in 2003.

The DMETL tasks for BCT combat engineers in major combat operations, as demonstrated in the early phases of Operation Iraqi Freedom were: (1) improve bed-down facilities, (2) breach border obstacles, (3) construct and repair bridges, (4) conduct urban operations, (5) clear and repair runways, (6) maintain and improve supply routes, (7) build life support areas (LSAs), (8) provide general engineering and survivability support,(9) repair infrastructure, (10) provide community assistance, and (11) conduct non-standard support missions (Martin 2003, 6-9).

The priority tasks conducted by combat engineers supported the assured mobility of the maneuver force. Combat engineers breached the complex border obstacles, five kilometers in depth, which consisted of dirt berms, tank ditches, and wire. They cleared and maintained the roads, MSRs, and critical airfields for medical evacuation and resupply. The combat engineers cleared roads blocked by mines, vehicles, and rubble in urban areas. Units also had to conduct multiple gap crossings over assault bridging and captured bridges that were cleared of enemy demolitions (Martin 2003, 6-9).

The next priority tasks conducted by combat engineers supported the force protection and survivability of the units. Combat engineers transported and destroyed

captured enemy ammunition and equipment. They emplaced protective barriers and berms with the equipment available. Then the tasks focused on general engineering support. Combat engineers conducted engineer assessments to repair infrastructure, assisted in the construction of bed-down facilities, command posts, ammo holding areas, helipads, fuel farms, water distribution points, field hospitals, and EPW holding areas. They supervised and employed local labor contractors, made quality of life improvements gravel pads, electrical, carpentry, drainage, showers, and latrines with the limited resources and equipment available (Martin 2003, 7-9).

The 130th Engineer Brigade Commander and V Corps Engineer also captured the engineer tasks during the transition to stability operations in Iraq. Many of the tasks were conducted by Echelon Above Divison (EAD) engineer battalions, but the tasks are relevant to combat engineers organic to the BCT, especially when the engineer battalions are not available in the BCT sector.

During the transition to stability operations, engineers across Iraq continued combat engineer and infantry missions, with special emphasis on transportation and destruction of captured enemy ammunition and caches. Engineers constructed and repaired basecamps, facilities, and infrastructure, conducted assessments of essential services, emplaced assault and fixed bridging, and installed and repaired electrical power generation and distribution. Combat engineers also conducted contract management, quality assurance, and oversight of local contractors (Martin 2003, 9-10).

The broad perspective of the senior engineer commander in Iraq was valuable to understand the missions across Iraq, and the perspective of the engineer company commanders echoed many of the critical tasks conducted by combat engineers. The

article by Captain Jason Railsback, who served in Baghdad as an engineer company commander in the 1st Armored Division during OIF-1, provided valuable data on the tasks his company conducted in support of what would now be an HBCT. Railsback's engineer company deployed with the standard MTOE equipment, which consisted of HMMWVs, M113s, M9 ACEs, HEMTTs, and SEEs, and emplaced the force protection materials for a maneuver brigade BCT while under sporadic fire in Baghdad. His company cleared fields of observation and fire; moved vehicles, debris, and trash; constructed force protection barriers, serpentines, guard towers, and survivability positions for security stations in Baghdad using earth-filled HESCO barriers, concrete barriers, concertina wire, chain link fencing, and other expedient materials. His company managed and transported the class IV construction and barrier materials, conducted the contract management and oversight of Iraqi contractors for additional force protection, life support projects for the BCT, and local area improvement projects to benefit local Iraqis (Railsback 2003, 15). Force protection designed and constructed by organic engineers is listed in the GMETS, CMETL and DMETL. It is a task that all BCTs must conduct in any operational theme across the full spectrum of operations.

The next selection of DMETL tasks came from a light engineer company commander in the 101st Infantry Division (Air Assault) and provided the IBCT perspective. Captain Aaron Magan commanded a light engineer company during the invasion of Iraq in OIF-1. His company transported and destroyed unexploded ordnance and large captured enemy ammunition caches; destroyed enemy equipment and demolished unstable structures; cleared captured bridges of explosives; and conducted hasty road crater repairs to support assured mobility. The company conducted

dismounted urban mobility operations with infantry units using demolitions, bolt cutters, and other tools to breach walls, doors, gates, and hasty road barriers (Magan, 2003, 25). As the situation transitioned to stability operations, his company conducted limited base camp construction tasks, route reconnaissance and classification, and civil-military operations in support of the BCT priorities (Magan 2003, 26).

The SBCT DMETL tasks conducted by engineers were identified by the first Stryker Brigade in Iraq. Major Heath Roscoe served as the brigade engineer and Captain Dean Mitchell commanded the 18th Engineer Company in the Sunni Triangle of Iraq in 2004. During this time the company conducted route clearance, provided mobility support to infantry, searched for, transported, and destroyed captured enemy ammunition and equipment caches, constructed detainee holding areas, and provided limited life support and force protection improvements (Roscoe 2004, 5-6).

Each of these articles was written before the implementation of U.S. Army modularity and contained the most relevant combat tasks. The author also incorporated observations of modular IBCTs during their initial JRTC rotations in 2004 and 2005. In four rotations, the observer controllers observed and noted similar trends of insufficient engineer company capability to conduct route reconnaissance and route clearance, identify and reduce explosive hazards, construct and maintain forward airstrips for helicopters and unmanned aerial sensors (UAS), construct survivability and force protection berms, and construct detention facilities. The observer-controllers noted that the Army of Excellence brigades usually had three sapper platoons to support three infantry battalions, but now had only two sapper platoons to support two infantry

battalions, one RS, one fires battalion, and the additional IBCT enablers (TRADOC Analysis Center 2005, A-2).

Based on the cited articles and the author's analysis, the top five high probability DMETL engineer tasks that each BCT must be prepared to conduct in major combat operations and stability operations were very similar. All the engineer leaders mentioned providing assured mobility to the maneuver unit, constructing force protection, and searching, transporting, and destroying captured enemy ammunition and equipment. Two other tasks that were often conducted by organic engineers were contract management and technical engineer reconnaissance, assessments, and classifications. These common engineer tasks are summarized below in Table 1. Each BCT's core mission, doctrinal mission, CMETL, and even DMETL were practically the same, and it was unclear to the author why the organic engineer missions and structures were so different.

Table 1. Summary of Common Engineer Tasks in Support of BCT DMETL
Route Clearance
Deliberate Breach (Mounted)
Deliberate Breach (Dismounted)
Gap Crossing
Road Repair
Survivability
Captured Enemy Ammunition
Engineer Recon
Contract Management

Engineer Capability Shortfalls

Engineer capability is grouped into elements, called "critical joint engineer capability elements," derived from the UJTL that are common across the joint operational environment (Watson 2004, 10). These engineer elements further define the broad engineer functions and are an effective way to assess the engineer capability in the BCTs. Although some elements have overlapping utility, the author characterized each element into a primary function and defined a unit of measure for each.

Route Clearance

Route Clearance Operations are deliberate or hasty sweeps of pre-existing roads and trails to identify and neutralize hazards using a combination of electronic, visual, and mechanical means in order to open and maintain the LOC for safe passage of combat and sustainment forces (FM 1-02 2004, 11-12). The unit of measure is a sapper squad with mine detectors, demolitions, and possibly a interim vehicle mounted mine detector (IVMMD) if available, to successfully conduct a hasty sweep (FM 3-90.6 2006, 11-16). The author selected one sapper squad per infantry or armor company as the benchmark.

Deliberate Breaching Operations

Deliberate breaching operations are synchronized combined-arms operations that employ a combination of tactics and techniques to reduce lanes in order to allow the maneuver of an attacking force to the far side of an obstacle covered by fire (FM 3-34.2 2002, 1-1). The unit of measure is breaching teams with reduction assets for a mounted breach and sapper squads for a dismounted breach. The author selected the planning factors of sufficient reduction assets to create a minimum of two lanes for an assaulting

battalion task force with a fifty percent combat loss of mobility assets as the benchmark (FM 3-34.2 2002, 1-11).

Gap Crossing Operations

Gap crossing operations are narrowly focused on the reduction of natural or man-made gaps utilizing mechanical equipment, normally bridging assets, or commercially procured or expedient materials in order to minimize a gap's impact on the commander's ability to maneuver (FM 3-90.12 2008, 2-1). The unit of measure is the number of organic tactical bridging assets, to include the joint assault bridge (JAB), the AVLB, or the REBS (FM 3-90.12 2008, 2-2). The author selected the benchmark of one tactical bridge system per maneuver battalion in the BCT.

Expedient Road Repair

Expedient road repair is the temporary restoration of damage caused by abnormal use, accidents, hostile forces, and severe environmental actions, made with the most readily available materials, in order to meet an immediate minimum need (FM 3-34.400 2008, 7-10). The unit of measure is the number of backhoe-type vehicles, such as SEEs or HMEEs, to augment a squad-sized road repair team equipped with a dump truck, grader, and hand tools that can complete minor repairs encountered on a five to fifteen mile stretch of road (FM 3-34.400 2008, 7-10). The author selected the benchmark of one backhoe-type vehicle per infantry or armor company to match the requirements for hasty route clearance.

Survivability Operations

Survivability operations are the development and construction of protective positions, such as earth berms, dug-in positions, overhead protection, and counter surveillance means to reduce the effectiveness of enemy weapon systems (FM 1-02 2004, 1-180). Combat engineers perform and provide field engineering advice, assistance, and equipment capability to maneuver elements in the construction of force protection measures, protective positions, and fighting positions (FM 5-103 1985, 2-1). The unit of measure is based on the number of heavy engineer equipment blade teams, such as two M9 ACEs or two DEUCEs, capable of berming or digging. The author selected the benchmark of one blade team per battalion in the BCT to include CAB, infantry, fires, BSB, and BSTB.

Dispose of Captured Enemy Ammunition

Captured enemy ammunition (CEA) caches are the source of the majority of explosive materials for improvised explosive devices. It is the capturing unit's responsibility to provide security of the CEA until the unit receives disposition instructions from Explosive Ordnance Disposal experts. The capturing unit must also safeguard, recover, evacuate, and destroy CEA, if not turned over to another unit or collection point (FM 4-30.16 2005, III-7). The unit of measure is the number of sapper squads with vehicle assets. The benchmark is one sapper squad with a vehicle per maneuver company to transport and dispose of CEA, as directed by EOD experts.

Reconnaissance Operations

Reconnaissance operations obtain, by visual observation or other detection methods, information about the characteristics, activities, or resources of an enemy or potential enemy, or to secure data concerning the meteorological, hydrographical, or geospatial characteristics and indigenous population of a particular area (FM 1-02 2004, 1-158). The unit of measure is the number of sapper squads and the benchmark is one sapper squad per maneuver company to conduct route reconnaissance, route classifications, and technical assessments of infrastructure and key terrain.

Contract Management

The contract management tasks conducted by combat engineers included the project design, contracting actions, quality assurance, and oversight inspections of civilian contractors to insure the project quality, scope, and intent were met. The unit of measure is sapper squads to serve as infrastructure reconnaissance teams and a battalion point of contact to track the progress of ongoing projects. The benchmark is one sapper squad per maneuver company, similar to the engineer reconnaissance benchmark above.

Assessment of the HBCT

In terms of the engineer functions of mobility and survivability, the HBCT engineer capabilities have been greatly reduced from the Army of Excellence or Force XXI design. As initially designed, organic HBCT engineer companies were not equipped to effectively reduce complex obstacles, conduct deliberate route clearance, or gap crossing operations in support of mobility. The addition of the ABV in the objective HBCT design gives the engineer company the ability to reduce complex obstacles and

conduct deliberate route clearance. The typical planning factors for combined arms breaching found in FM 3-34.2, *Combined Arms Breaching,* are to plan for reduction of two breach lanes per assaulting task force, plan for 50% loss in mobility assets, and plan one combat engineer platoon per lane (FM 3-34.2 2002, 1-10).The ABVs in the engineer company and the mine clearing plows and rollers in the CABs are the explosive obstacle breaching assets available to the HBCT, but it lacks gap crossing assets. The drastic reduction in M9 ACEs decreases the amount of survivability effort available to the HBCT or CAB commander for protection. The author could not determine an increase or decrease due to modularity in the already limited general engineering support. However, the HBCT gained capability in the geospatial support function with the organic terrain team and DTSS-L equipment.

The HBCT design lost the engineer battalion commander and staff for training, maintenance, developing, readiness, and oversight of the engineer capabilities in the BCT and the loss of a senior field grade engineer to provide informed recommendations to the HBCT commander. The terrain team and engineer plans officers have increased the HBCT staff's organic capability beyond that of the Army of Excellence brigade. The HBCT gained engineers assigned directly to the CAB headquarters. Previously, engineers temporarily came to the battalion task force staff from a habitual relationship developed between a task force and an engineer company.

In terms of the mobility function, engineers are expected to maintain the mobility common operating picture, conduct mobility assessments, detect and neutralize explosive hazards, enhance mobility in complex and urban terrain, and cross gaps. The engineer officers and NCOs assigned to the HBCT and CAB headquarters provide engineer input

to the planning, requesting, and allocating engineer resources. They track the current situation, maintain situational awareness of the mobility common operating picture, and brief the commander. Majors at the HBCT level and captains at the CAB level, with the appropriate NCO support, have been sufficient for current operations, but it is critical to have full manning with the appropriate grades (Eckstein 2008, 63). The new HBCT design does not change these engineer staff positions and will have no effect on the ability to maintain an effective mobility common operating picture.

Route reconnaissance and mobility assessments are conducted by engineer squads. There are nine 10-ten man engineer squads in the new HBCT and twelve 8-man squads in the old HBCT design which are sufficient to conduct route reconnaissance, engineer reconnaissance, and bridge classification in support of the HBCT. HBCTs are capable of conducting deliberate obstacles clearance with ABVs, dismounted detection with their HSTAMIDs, and neutralization with hand emplaced explosives or EOD support. HBCT engineers are equipped to conduct deliberate route clearance with tracked ABVs but special wheeled route clearance vehicles are preferred for the extended distances on main supply routes in Iraq and Afghanistan. The special wheeled route clearance vehicles are high-demand low-density items across the U.S. Army and are consolidated within Route Clearance Companies in the modular engineer force pool, and usually assigned to a multi-functional engineer battalion supporting a division.

The HBCT design has sufficient mobility enhancement and mounted obstacle reduction capability in the engineer company. ABVs, M9 ACE, and dismounted engineer squads with demolitions and hand tools enhance mobility in urban areas and provide obstacle reduction capability. The full width plows and Mongoose MICLIC explosive

line clearing charges on the ABVs and the mine clearing rollers and plows in the CABs reduce anti-tank and anti-personnel obstacles.

The HBCT engineer company does not include any organic gap crossing assets. HBCTs rely on Mobility Augmentation Companies (MAC) for armored vehicle launched bridges (AVLB) for gaps up to sixty feet and the Multi-role Bridge Companies (MRBC) for ribbon-bridge and medium girder bridge to cross larger gaps that exceed sixty feet (FM 3-90.12 2008, A-11). The MACs and MRBCs have the bridging assets and are available in the modular engineer force pool, usually assigned to a multi-functional engineer battalion supporting a division.

In terms of the countermobility function, engineers emplace obstacles and attack enemy freedom of maneuver. The HBCT engineer company used to have two Volcano scatterable mine systems per CAB, but the new companies do not retain any Volcano systems. The available M9 ACEs were not sufficient to create substantial obstacles and standard minefield emplacement was not a task conducted in Iraq or Afghanistan. Dismounted engineer squads, aided by M9 ACE and SEEs, can effectively emplace wire obstacles, road craters, road blocks, and situational obstacles. These obstacles can be extremely effective in restrictive terrain and urban areas, but limited in open terrain due to the available engineer effort.

In terms of the survivability function, engineers enhance force protection and enhance infrastructure protection. The HBCT engineer company has three SEEs, four HEMTTs, and six ACEs. The company cannot effectively dig vehicle fighting positions for the BCT’s M1 or M2 vehicles in a deliberate defense. Dismounted squads with hand tools, aided by the engineer equipment, can construct limited force protection and

infrastructure protection. In fairly permissive environments, the engineer company can magnify its effort by supervising LOGCAP, local contractors, or host nation labor and equipment in the construction of force protection and infrastructure protection.

In terms of the geospatial support function, engineers manage geospatial data for the commander, staff, and subordinate units. This element of engineer capability supports all the functions. The brigade terrain team, equipped with the DTSS-Light is a significant capability for the HBCT.

The author included the tasks of rapidly deploying earthmoving capability, constructing and repairing air and ground LOCs, and restoring and repairing infrastructure as general engineering functions because of the larger scale of engineer effort required in relation to the BCT's perspective and its organic engineer capability. General engineering tasks are well outside of the capability of the HBCT engineer company that has only limited combat engineer capability. These tasks must be assigned to other engineer companies within the modular engineer force pool, such as a Horizontal Construction Company, a Vertical Construction Company, or an Equipment Support Company.

Overall, the HBCT has limited engineer capability and relies heavily on the engineer company's dismounted squads to provide the limited engineer support to accomplish the CMETL and DMETL tasks. Table 2 summarizes the author's assessment.

Table 2. Assessment of Engineer Capability in HBCT	
Engineer Task Supporting DMETL	Assessment
Route Clearance	Yes
Deliberate Breach (Mounted)	Yes
Deliberate Breach (Dismounted)	Yes
Gap Crossing	No
Road Repair	No
Survivability	No
Captured Enemy Ammunition	Yes
Engineer Recon	Yes
Contract Management	Yes

Assessment of the IBCT

The geospatial support function has been greatly increased with the addition of the terrain team equipped with DTSS-Light in the IBCT headquarters. Engineer planning and C2 increased with officers and NCOs assigned to the IBCT headquarters and no longer relying on habitual relationships. The limited capability of the engineer company to conduct mobility, countermobility, survivability, and sustainment engineering missions is addressed in the mission statement and MTOE documents. The main mobility assets in the company are dismounted engineer squads with HSTAMIDS, demolition sets, and pioneer tools to support dismounted infantry maneuver. The dismounted engineer squads are also the main countermobility assets with HMMWVs, tools, and trailers to haul, supervise, and emplace barrier materials and obstacles for the IBCT. While the engineer squads can provide, equip, and supervise manual labor, the equipment section provides the heavy equipment to support mobility, countermobility, survivability and general engineering tasks. The equipment section can make small improvements and hasty

repairs to chokepoints and combat trails with SEEs, DEUCEs, skid steers, bucket loaders, and dump trucks for mobility. They can also move heavier loads of soil, debris, and barrier material to support countermobility, survivability, and general engineering tasks than the engineer squads. These companies are versatile and can support the basic needs of an IBCT, but were designed for “limited support.” Any substantial engineer effort in mobility, countermobility, survivability, or general engineering will exceed their capability and will require augmentation from the engineer force pool.

The IBCT engineers support the mobility function by maintaining the mobility common operating picture, conducting mobility assessments, detecting and neutralizing explosive hazards, enhancing mobility in complex and urban terrain, and crossing gaps. The engineer officers and NCOs assigned to the IBCT headquarters provide engineer input to the planning, requesting, and allocation of engineer resources. They track the current situation, maintain situational awareness of the mobility common operating picture, and brief the commander. Engineer majors serve at the IBCT headquarters level, but an NCO serves at the infantry battalion level. An engineer platoon leader usually serves as the task force engineer with the infantry battalion. The feedback from modular IBCTs is that the assigned engineer NCO is insufficient to plan and execute the mobility, countermobility, survivability, geospatial, and engineer reconnaissance tasks (TRADOC Analysis Center 2005, A-2).

Just like in the HBCT, route reconnaissance and mobility assessments are conducted by engineer squads. However, there are only six 8-man squads in the IBCT design which are insufficient to conduct route reconnaissance, engineer reconnaissance, and bridge classification in support of the IBCT (TRADOC Analysis Center April 2005,

A-2). IBCT engineers are not equipped to conduct mounted detection and neutralization of explosive hazards or to conduct route clearance with their organic vehicles. They are capable of conducting dismounted detection with their HSTAMIDs and neutralization with hand emplaced explosives or EOD support. Mounted route clearance equipment is consolidated in the specialized Route Clearance Company and not currently MTOE authorized for an organic engineer company in a BCT.

The IBCT design includes insufficient mobility enhancement and obstacle reduction in urban areas. This capability is supported by dismounted engineer squads with demolitions and hand tools. The IBCT engineer company design does not include any organic gap crossing assets for the wheeled vehicles in the IBCT. Therefore, IBCTs must rely on Mobility Augmentation Companies for AVLB or Multi-role Bridge Companies for ribbon-bridge, medium girder bridge, and assault boats to cross wet gaps.

In terms of the countermobility function, engineers emplace obstacles and deny the enemy's freedom of maneuver. The IBCT engineer company has no Volcano scatterable mine systems and only two DEUCEs in the obstacle section. These vehicles are insufficient to dig significant obstacles. Standard minefield emplacement is not a task used in Iraq or Afghanistan. Dismounted engineer squads, aided by SEEs, Bobcats, and haul assets, can effectively emplace wire obstacles, road craters, road blocks, and situational obstacles. These obstacles can be extremely effective in restrictive terrain and urban areas, but limited in open terrain due to the available engineer effort.

In terms of survivability, engineers enhance force protection and enhance infrastructure protection. The IBCT engineer company has four SEEs, one bucket loader, three Bobcat skid steers, two medium dump trucks and two flat bed tractor trailer

combinations to assist in force protection construction. The SEEs can dig crew served positions and survivability positions for C2 nodes, artillery, and sustainment. Dismounted squads with carpenter hand tools, aided by the engineer equipment can construct limited force protection and infrastructure protection. In more secure and stable environments, the engineer company can magnify its effort by supervising LOGCAP, contractors, or host nation labor and equipment in the construction of force protection and infrastructure protection.

In terms of the geospatial support function, engineers manage geospatial data for the commander, staff, and subordinate units. This element of engineer capability supports all the functions. The brigade terrain team, equipped with the DTSS-Light is a significant capability for the IBCT.

General engineering tasks are also well beyond the capability of the IBCT engineer company. These tasks must be assigned to other engineer companies within the modular engineer force pool, such as a Horizontal Construction Company, a Vertical Construction Company, or an Equipment Support Company.

Overall, the IBCT has limited engineer capability and relies heavily on the engineer company's dismounted squads to provide the limited engineer support to accomplish the CMETL and DMETL tasks assigned. A summary is provided at Table 3.

Table 3. Assessment of Engineer Capability in IBCT	
Engineer Task Supporting DMETL	Assessment
Route Clearance	No
Deliberate Breach (Mounted)	No
Deliberate Breach (Dismounted)	No
Gap Crossing	No
Road Repair	No
Survivability	No
Captured Enemy Ammunition	No
Engineer Recon	No
Contract Management	No

Assessment of the SBCT

The SBCT engineers support the mobility function by maintaining the mobility common operating picture, conducting mobility assessments, detecting and neutralizing explosive hazards, enhancing mobility in complex and urban terrain, and crossing gaps. The engineer officers and NCOs assigned to the SBCT headquarters provide engineer input to plan, request, and allocate engineer resources. They track the current situation, maintain situational awareness of the mobility common operating picture, and brief the commander. A major, a captain, and the terrain team serve at the SBCT level but no subordinate battalions have any assigned engineer staff. This seems insufficient for the battalions to plan and execute the mobility, countermobility, survivability, geospatial, and engineer reconnaissance tasks.

As with the other BCTs, route reconnaissance and mobility assessments are conducted by engineer squads. There are nine 9-man squads in the SBCT design which are sufficient to conduct route reconnaissance, engineer reconnaissance, and bridge

classification in support of the SBCT. They are capable of conducting dismounted detection with their HSTAMIDs and neutralization with hand emplaced explosives or EOD support. The mounted route clearance equipment is consolidated in the specialized Route Clearance Company, available in the modular engineer force pool, usually assigned to a multi-functional engineer battalion in the division.

The SBCT design includes sufficient mobility enhancement and obstacle reduction in urban areas. This capability is supported by mounted engineer support vehicles or dismounted engineer squads with demolitions and hand tools. The squads have rollers, plows, and Mongoose MICLIC systems for lane reduction. The Mobility Support Platoon of the SBCT engineer company has one hundred feet of Medium Girder Bridge (MGB) and four REBS capable of crossing a forty-two foot gap with vehicles that weigh fifty tons or less. For gaps that exceed the organic one hundred foot span of MGB, SBCTs rely on Multi-role Bridge Companies (MRBC) for ribbon-bridge, medium girder bridge, and assault boats.

The combat mobility platoons are the main countermobility assets with volcano mine systems, engineer squads, tools, and trailers to haul, supervise, and emplace barrier materials and obstacles for the SBCT. While the engineer squads can provide, equip, and supervise manual labor, the mobility platoon provides the heavy equipment to support any mobility, countermobility, survivability and general engineering tasks. The mobility platoon has similar equipment but more than the IBCT’s engineer equipment section. The mobility platoon can make small improvements and hasty repairs to chokepoints and combat trails with HMEEs, DEUCEs, and skid steers. With the PLS systems, they can

transport large loads of construction and barrier material to support countermobility, survivability, and general engineering tasks.

In terms of the countermobility function, the SBCT engineer company has three Volcano scatterable mine systems, six DEUCEs, and six HMEEs. These vehicles are not sufficient to dig significant obstacles. Standard minefield emplacement is not a task conducted in Iraq or Afghanistan. Dismounted engineer squads, aided by HMEEs, Bobcats, and haul assets, can effectively emplace wire obstacles, road craters, road blocks, and situational obstacles. These obstacles can be extremely effective in restrictive terrain and urban areas, but limited in open terrain due to the available engineer effort.

In terms of the survivability function, engineers enhance force protection and enhance infrastructure protection. The SBCT engineer company has six HMEEs, six DEUCE, and six HEMTT PLS trucks with trailers to assist in force protection construction. The HMEEs and DEUCEs can dig crew served positions and survivability positions for command and control nodes, artillery, and sustainment. Dismounted squads with hand tools, aided by the engineer equipment can construct limited force protection and infrastructure protection. In fairly permissive environments, the engineer company can magnify its effort by supervising LOGCAP, contractors, or host nation labor and equipment in the construction of force protection and infrastructure protection.

In terms of the geospatial support function, engineers manage geospatial data for the commander, staff, and subordinate units. This element of engineer capability supports all the functions. The brigade terrain team, equipped with the DTSS-Light is a significant capability for the SBCT.

In terms of the general engineer function, the tasks are well outside of the capability of the SBCT engineer company with only limited combat engineer capability for construction and earthmoving. These tasks must be assigned to other engineer companies within the modular engineer force pool, such as a Horizontal Construction Company, a Vertical Construction Company, or an Equipment Support Company.

Overall, the SBCT has sufficient engineer capability for mobility tasks, but relies heavily on external engineer capability to provide the engineer support to fully accomplish other CMETL and DMETL tasks for the BCT. A summary is provided at Table 4.

Table 4. Assessment of Engineer Capability in SBCT

Engineer Task Supporting DMETL	Assessment
Route Clearance	Yes
Deliberate Breach (Mounted)	Yes
Deliberate Breach (Dismounted)	Yes
Gap Crossing	Yes
Road Repair	No
Survivability	No
Captured Enemy Ammunition	Yes
Engineer Recon	Yes
Contract Management	Yes

Courses of Action

In order to accomplish the essential CMETL and DMETL tasks identified by engineer leaders in Iraq, the author proposed three courses of action. The first course of action assumed no changes to the current engineer structure in the BCTs and serves as the

basis for comparison. The first course of action has nine sapper squads in the HBCT, nine sapper squads in the SBCT, but only six sapper squads in the IBCT.

The second course of action added engineer capability to accomplish more of the essential tasks and standardizes the engineer company structural integrity across all BCTs. The author developed the second course of action by adding a third sapper platoon with three sapper squads and appropriate equipment to the IBCT, while the HBCT and SBCT engineer companies remained the same. Due to the heavy reliance on sapper squads, this provided nine sapper squads for each type of BCT. This course of action was based more upon a personnel solution than an equipment solution.

In the attempt to accomplish more of the identified tasks, the third course of action built upon the additional sapper platoon in the IBCT by adding breaching and bridging equipment to the IBCT and HBCT. The SBCT engineer company remained the same throughout the author's courses of action. This course of action was based upon a combination of additional personnel and specialized equipment as the solution. The third course of action maintained structural integrity, added additional engineer capability, but failed to fully conduct all the essential tasks. The added size made it harder to deploy and the added personnel require important balancing decisions for the Army force structure.

Evaluation Criteria

Route clearance, deliberate breaching, gap crossing, expedient road repair survivability, captured enemy ammunition disposal, reconnaissance, and contract management were essential tasks identified by the author and were used as the evaluation criteria. Each of these evaluation criteria served as a measurement to differentiate between the proposed courses of action. In the next paragraphs, the author defined and

established the units of measure and benchmarks for the evaluation criteria. The organic engineer company has the closest relationship to BCT units and should have the capability to conduct these tasks.

Analysis

In the following tables, the author used a "1" to indicate that the company met the benchmark and "0" indicated the company failed the benchmark. As mentioned in previous chapters, the author identified three courses of action for the engineer companies. The author did not propose any changes to the MTOE authorizations of the engineer companies in the first course of action. The analysis is summarized below in Table 5.

Table 5. Analysis of Course of Action 1
(No Change to BCT Engineer Companies)

	HBCT	IBCT	SBCT
Route Clearance	1	0	1
Deliberate Breach (Mounted)	1	0	1
Deliberate Breach (Dismounted)	1	0	1
Gap Crossing	0	0	1
Road Repair	0	0	0
Survivability	0	0	0
Captured Enemy Ammunition	1	0	1
Engineer Recon	1	0	1
Contract Management	1	0	1
Total	6/9	0/9	7/9

In the second course of action shown in Table 6, the addition of a third combat engineer platoon with three sapper squads greatly increased the capability of the IBCT engineer company at a relatively small cost. The additional personnel consisted of one officer and twenty-seven enlisted. The additional equipment necessary to equip the platoon to an equivalent level as the original two platoons was five HMMWVs, four trailers, six HSTAMIDs, three demolition kits, three carpenters kits, and three pioneer tool kits. As shown in the comparison between Table 5 and Table 6, these additional personnel and minor equipment significantly increased the capability of the company to execute five of nine essential tasks, instead of zero in its original design. This increase also gave the IBCT engineer company the ability to successfully conduct the same essential tasks as the HBCT engineer company, except for the mounted deliberate breach task.

Table 6. Analysis of Course of Action 2
(Add Third Sapper Platoon to IBCT)

	HBCT	IBCT	SBCT
Route Clearance	1	1	1
Deliberate Breach (Mounted)	1	0	1
Deliberate Breach (Dismounted)	1	1	1
Gap Crossing	0	0	1
Road Repair	0	0	0
Survivability	0	0	0
Captured Enemy Ammunition	1	1	1
Engineer Recon	1	1	1
Contract Management	1	1	1
Total	6/9	5/9	7/9

The third course of action built upon the additional IBCT engineer platoon and added tactical bridging assets to give the IBCT engineer company the ability to conduct six of the nine essential tasks as shown in Table 7. The third course of action also added tactical bridging assets to the HBCT engineer company. The author proposed the addition of four assault bridge systems to increase the capability to conduct seven of the nine essential tasks in support of the HBCT.

Table 7. Analysis of Course of Action 3

(Add Third Sapper Platoon and Bridges to IBCT;
Add Bridges to HBCT)

	HBCT	IBCT	SBCT
Route Clearance	1	1	1
Deliberate Breach (Mounted)	1	0	1
Deliberate Breach (Dismounted)	1	1	1
Gap Crossing	1	1	1
Road Repair	0	0	0
Survivability	0	0	0
Captured Enemy Ammunition	1	1	1
Engineer Recon	1	1	1
Contract Management	1	1	1
Total	7/9	6/9	7/9

Comparison

In terms of deployability, the second and third courses of action increased the end-strength, tonnage, and square footage of the unit. In the second course of action, the addition of twenty-eight more combat engineers to the IBCT, an increase of

approximately one percent, seemed small in comparison to the increase in capability. Five HMMWVS and four trailers added approximately ten tons and nine hundred square feet to the unit's authorized unit equipment list (FM 55-15 1997, 3-56). The third course of action added tactical bridge assets such as four HEMTTs with REBS to the IBCT and increased the authorized unit equipment list by approximately forty tons (FM 55-15 1997, 3-53). With the addition of four M1 chassis bridge vehicles, the author estimated an additional two hundred and ninety tons and two thousand four hundred square feet in the HBCT engineer company. This additional size provides the appropriate organic flexibility, versatility, and capability to cross small gaps, not currently available in the IBCT or HBCT.

In terms of sustainability, the second and third courses of action both added personnel and equipment. In the second course of action, there were no new types of equipment added to the IBCT engineer company that required operational or maintenance changes to the current sustainment section. The additional items were already in the company's inventory. There were no significant sustainment impacts, but a substantial capability increase by adding the third sapper platoon to the IBCT. In the third course of action, four HEMTT-based Common Bridge Transporter vehicles with REBS were added to the IBCT engineer company which required augmentation to the maintenance section. There were no HEMTTs in the IBCT engineer company and the change required the addition of bridge engineers, military occupational specialty of 21C, to operate these pieces of equipment in the IBCT. This could be mitigated by the mechanics from the IBCT BSB, because other units in the IBCT have HEMTTs. However, the HBCT engineer company did not require special operators for the assault bridge. Operators and

maintainers are already part of the HBCT engineer company sustainment section because the M1 chassis of the ABV was already part of the company's inventory. Additional bulk fuel storage and distribution to support four additional M1 chassis vehicles must also be recognized in the third course of action.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

Conclusion

Chapter 5 provides the author's conclusion and recommended course of action to address the BCT engineer capability gaps and identifies future research areas related to this topic. The author's research indicated that all BCTs had sufficient geospatial engineering capability, only the SBCT had the minimum necessary combat engineer capability, and all BCTs required substantial engineer augmentation for general engineering missions. The HBCT and IBCT designs did not have sufficient organic engineer capability to fully support the most common combat engineer DMETL tasks in full spectrum operations.

Organic engineer capacity in each BCT varied greatly, but the mission statements and CMETLs for each BCT were similar. Each unit's structure was different, the SBCT and HBCT engineer companies had nine sapper squads, but the IBCT had only six sapper squads. Different types and amounts of special engineer equipment, namely bridging and breaching, also varied among the BCTs and proved to be a key difference in BCT engineer capability. Once again, the SBCT engineer company proved more capable with its organic assault bridging and obstacle breaching equipment. Both the HBCT and IBCT lacked assault bridging. The similarity in missions and approved CMETLs for each BCT demonstrated and reinforced the need for similar engineer capability organic to each BCT.

Not only was the IBCT engineer company insufficient to fully support the IBCT CMETL, but also the most common DMETL tasks of route clearance, deliberate

breaching, gap crossing, expedient road repair survivability, captured enemy ammunition disposal, reconnaissance, and contract management.

Based on the author's analysis, the SBCT had sufficient organic engineer capability to conduct geospatial, mobility, and countermobility operations, but limited survivability and general engineering capability in support of full spectrum operations. The SBCT engineer company can meet the immediate needs of the SBCT but must rely heavily on EAB engineer companies to meet general engineering mission requirements.

The HBCT and IBCT had sufficient organic engineer capability to conduct geospatial operations, but lacked sufficient personnel and equipment to fully conduct the other engineer functions in support of BCT conducting full spectrum operations. In order to resolve this shortage in engineer capability, the author made the following recommendations.

Recommendation

Throughout the author's research, there was a heavy emphasis on the assured mobility tasks conducted by combat engineers in close coordination with BCT units. Specific mobility tasks of route clearance, deliberate breaching, and gap crossing are combined arms operations that require synchronization, detailed integration, and rehearsals between maneuver units and engineers to succeed.

For this reason, the author recommended the third course of action to fully equip the BCT engineer companies with sufficient organic mobility assets. As developed in Chapter 4, the recommended course of action added four assault bridges with operators to the HBCT, added an additional sapper platoon of twenty eight Soldiers, added four REBS to the engineer company, and two engineer captains to serve in the infantry battalion

headquarters for the IBCT. The author proposed no changes to the SBCT engineer company.

Without these additional assets, IBCTs and HBCTs depend on Mobility Augmentation Companies from the EAB engineer force pool to provide assault gap crossing capability that should be inherent within the BCT organization. The synchronization, detailed integration and rehearsals necessary to successfully execute breaching and gap crossing operations should be organic to the BCT. The BCTs should not rely on external engineer units to provide these mission essential capabilities.

None of the BCT engineer companies are manned or equipped to complete all the survivability or road repair tasks in a BCT, but they can provide limited support. This gap in general engineering capability is recognized, but insufficient to reorient the combat engineering focus of the BCT engineer company. All BCT engineers must plan and request external engineer unit support from a horizontal engineer company or equipment support company to fully execute the BCT's general engineering and construction requirements. With increasing engineer construction requirements such as the construction of expeditionary outposts, force protection measures, forward helicopter and UAS airstrips, and detention facilities, but limited organic capability, it is vital for BCT engineer planners and staff to request the appropriate external engineer force pool capabilities to support the BCT (TRADOC Analysis Center 2005, A-2).

To improve the HBCT engineer company's mobility support to HBCT offensive operations, the author recommended the HBCT maintain six ABVs and add four assault bridging assets capable of supporting all HBCT vehicles. Based on current operations and in order to enhance deployability, the author recommended that the HBCT remove the

M548 Volcano system and continue to assume risk without these countermobility assets. The risk can be mitigated by relying on squad emplaced situation obstacles and smart munitions like the MOPMs, Hornet, and Spider.

To improve the IBCT engineer company's mobility support to IBCT offensive operations, the author recommended adding an engineer captain to each infantry battalion, like the CABs in the HBCT, adding a third combat engineer platoon to the engineer company to support the other battalion units in the IBCT, and adding four REBS with operators to support gap crossing of IBCT wheeled vehicles. Based on current operations and in order to retain deployability, the author recommended that the IBCT continue to assume risk with no vehicular countermobility assets and also rely on squad emplaced situation obstacles and smart munitions like the MOPMs, Spider, and Hornet.

Areas for Future Research

This thesis identified and analyzed organic engineer capability gaps in support of the most common DMETL, then recommended personnel and materiel changes to the structure of the HBCT and IBCT engineer companies to address the gaps. Any proposed change in capabilities will likely create second and third order effects. Future researchers may further investigate the other impacts of Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) issues within the U.S. Army related to changes to the BCT design, the additional engineer support, and the associated cost estimates.

Additional engineer positions in the IBCT and HBCT take positions away from other units because of the mandated U.S. Army end strength. The advantages and disadvantages of this recommendation, at the expense of EAB engineer structure or other

branches, are likely points of friction and areas of future research. The appropriate HBCT assault bridging equipment is currently found in the Mobility Augmentation Company and would be the first choice for sourcing the HBCT engineer companies to an acceptable level. Future research and analysis to determine the strengths, weaknesses, opportunities, and risks to the BCTs, the EAB engineer force pool, and the U.S. Army are needed but beyond the scope of this thesis.

The debate continues whether an engineer company or engineer battalion has the appropriate structure to support a BCT and will likely extend well into the future. The author's recommendation added personnel and equipment in an effort to optimize the existing engineer company instead of creating an organic engineer battalion in each BCT. The author did not address the unique engineer-specific training and certification process an engineer company commander must resource and supervise within a BCT in order to successfully conduct these tasks in support of full spectrum operations.

As heavy consumers of bulk fuel and construction material, future research into the added logistics and sustainment requirements to support additional engineer capability is recommended. The most obvious examples of increased requirements are movement, maintenance, recovery, fuel storage, and unit basic loads of ammunition.

The author analyzed and identified capabilities gaps in organic engineer support to the BCT from a strictly engineer perspective. The recommended course of action is primarily a personnel and materiel solution to address gaps in the common engineer tasks supporting the DMETL. The need for further research into the other components of DOTMLPF is recognized but beyond the scope of this thesis.

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